ASTRO

WUPPE LEVEL 0
ASTRO-01A

WUPPE LEVEL 0/DOWNFIELD
ASTRO-01A & 01C

ZERO ORDER DETECTOR (ZOD)
ASTRO-01C

WUPPE ENGINEERING DATA
ASTRO-01D

THESE DATA SETS CONSIST OF 8 MAGNETIC TAPES. THE D TAPES ARE 4MM AND THE C TAPES ARE 8MM. A COPY OF THE TAPE FORMATS HAVE BEEN INCLUDED IN THE CATALOG. THE D AND C NUMBERS ARE LISTED BELOW.

DATA SET ID#	D#	C#	FILES
ASTRO-01A	DD-108889	DC-032914	17
ASTRO-01A & 01C	DD-108890	DC-032915	14
ASTRO-01C	DD-108891	DC-032916	17
	DD-108892	DC-032917	10
	DD-108893	DC-032918	3
	DD-108894	DC-032919	3
ASTRO-01D	DD-108895	DC-032920	10
	DD-108896	DC-032921	22

ASTRO-01D

WUPPE Data Archive
Level 0 Engineering Data Postscript files

07 October 1992

by Marilyn R. Meade

o Description of the Instrument

The Wisconsin Ultraviolet Photo-Polarimeter Experiment (WUPPE) is one of three ultraviolet telescopes on the ASTRO-1 payload which flew aboard the space shuttle Columbia during a nine day mission in December 1990. WUPPE is a 0.5m f/10 Cassegrain telescope and spectropolarimeter. It obtained simultaneous spectra and polarization measurements, with a spectral resolution of about 10A, from 1400 to 3200A. A set of halfwave plates at 6 different angles provide spectropolarimetric modulation with 10A resolution on point sources through apertures from 6 to 40 arcsec. A "Lyot" analyzer is used to provide 50-100A spectropolarimetric resolution on faint point targets and diffuse nebulae. The typical diffuse object aperture was 3x50 arcsec. Calibrations of instrumental polarimetric efficiency, residual polarization, position angle registration, and flux sensitivity were performed by a combination of preflight laboratory measures and in-flight standard star observations. The data are corrected for telemetry errors, thermal background, cosmic ray hits, second order contamination, pointing errors, and instrumental polarization, which is roughly 0.05%.

o Level 0 Data

Level 0 data products include Zero Order Detector (ZOD) camera images, spectrometer scans and housekeeping (General Measurement Loop (GML)) data.
The WUPPE data have been stripped from the Goddard SpaceLab Data Processing Facility (SLDPF) tapes.

o GML Housekeeping Data

Engineering/Operational data plots have been made for 118 values contained in the WUPPE GML, one plot per value for each 12 hour time slice (18 plots for the entire mission for each of the 118 values, about 2100 plot files in all). These data are read out every second and include such information as temperatures, gains, voltages, currents, apertures and filters selected, pitch and yaw offsets, door and motor positions and various other hardware and software values. The IMCS status word plots have also been included here in similar 12-hour time slices. Plots will be provided in standard PostScript format for those interested in these data. Also included are overlays for each time slice (in the same scale as the PostScript files) which show when (and which) targets were observed by WUPPE.

The following data are provided in Postscript files.

From the WUPPE SLDPF tapes:

GML Serial Msg #1 Data	GML Analog Data	GML Digital Data
1 = Preview Sequence	1 = Heater Input Current	1 = Select Aperture
2 = Current Sequence	2 = Heater Input Voltage	2 = Aperture Ccw/Cw
3 = Current Aperture	3 = Main Input Current	3 = Select Filter Mt
4 = Filter	4 = Main Input Voltage	4 = Filter/Door Ccw/
5 = Camera Magnitude	5 = LVPS Motor Current	5 = Select Sec Mtr 1
6 = Planned Camera Mag	6 = DEP Radiator Temp	6 = Select Sec Mtr 2
7 = Camera Exposure	7 = Spectrometer Bay Temp	7 = Select Sec Mtr 3
8 = TV Mode	8 = Primary Mirror Temp	8 = Sec Mtr 1 In/Out
9 = Spectrometer Magnitude	9 = Secondary Mirror Temp	9 = Sec Mtr 2 In/Out
10 = Planned Spec Magnitude	10 = Power Switcher Temp	10 = Sec Mtr 3 In/Out
11 = Spectrometer Frametime	11 = TEC Hot Side Temp	11 = Select Door Mtr
12 = Spectrometer Log Rate	12 = Reticon Broad Temp	12 = Dis/Ena F/A Sens
13 = Planned Spec Log Rate	13 = Reticon Op Temp	13 = Filter Fiducial
14 = Signal Saturation A	14 = LVPS Radiator Temp	14 = Aperture Fiducia
15 = Signal Saturation B	15 = LVPS Ring Temp	15 = Test Lamp On/Off
16 = TEC Setpoint	16 = +5 CPU	16 = DEP Active
17 = Planned Aperture	17 = +/-12V DEP	17 = Filter Encoder
18 = WUPPE Status	18 = +5V Detector	18 = Aperture Encoder
19 = Focus (microns)	19 = +/-15V Detector	19 = Bkup Door Open
20 = Time Remain: Frame	20 = +28V HVPS	20 = Bkup Door Closed
21 = Time Remain: Sequence	21 = +28V Motor	21 = Latch Unlk/Lk
22 = Time Remain: Object	22 = +12V TEC	22 = RAM Selected (A/
23 = Pitch Guide Error	23 = SPD Gain	23 = Bkup Door Open/C
24 = Yaw Guide Error	24 = ZOD Gain	24 = Bkup Door/Off/On
25 = Pitch Offset	25 = Bright Object Sensor	25 = Filter Motor Ove
26 = Yaw Offset	26 = Audio Peak Amplitude	26 = Aperture Motor O
27 = Planned Pitch Offset	27 = Sec. Motor #1 Pos	27 = IMC HV On/Off
28 = Planned Yaw Offset	28 = Sec. Motor #2 Pos	28 = DEP Selected (A/
29 = Pitch Bias Offset	29 = Sec. Motor #3 Pos	29 = ZOD HVPS Off/On
30 = Yaw Bias Offset	30 = Pri-Sec Position #1	30 = SPD HVPS Off/On
31 = TV Thr/Scale	31 = Pri-Sec Position #2	31 = Std Monitor Off/
32 = TEC Temperature Error	32 = Pri-Sec Position #3	32 = Prom Write Off/O
33 = IMC Status/Count		33 = TEC Voltage Cntr
34 = Camera % Sat		34 = Focus LVDT
35 = DEP Door Open		35 = ZOD Signal from
36 = DEP Door Closed		36 = SAA Flag
37 = WCO		37 = IPS Cmd Flag
38 = WED		38 = Number of Steps
39 = Camera Gate		39 = SW ZOD Gate
40 = Spectrometer Gate		40 = SW SPC Gate
		41 = SW ZOD Gain
		42 = SW SPC Gain
		43 = PFK Flag
		44 = Item No.
		45 = Item Parameter
		46 = ID Occasional Da

From the IMCS SLDPF tapes:
IMCS Status Word

o Level 0 Engineering Data File naming convention

```
      M
DAYxxAnn.PS
      D
```

where
xx is the MET day number times 10 (00,05,10,...,85) (on unix, the files we 0.0,0.5,1.0...but VMS will not accept the extra ".")

M is data from Serial Message #1 (see above)
A is Analog data
D is Digital data

nn is the plot number, as given in the above list.

For example, plot file "day70a04.ps" is the main input voltage plot from day 7.0.

IMCS status plots:

istatusxx.ps

where xx is the MET day number defined above.

o Sample Postscript File

DAY70A29.PS has been copied into

MADRAF::MEADE:[MEADE.LEVEL0.POSTSCRIPT]

This is the Secondary Motor #3 Position from day 7.0.
(A printout of this plot is included.)

o File verification

This file has been printed on postscript printers both at SAL running ultrix and at the Astronomy Dept running VMS.
The sample file was verified by the NSSDC (Ed Kemper 9/25/92).

o The complete data set

The entire set of PostScript files has been written to a DAT tape by the unix "tar" command. There are 10 "tar files" on this DAT tape. Each of the first "tar files" includes 236 PostScript files of the engineering data for one MET day. The 10th "tar file" includes 18 PostScript files of the IMCS status word.

tar file #	contents
1	MET day 0 Engineering data PostScript files
2	MET day 1
3	MET day 2
4	MET day 3
5	MET day 4
6	MET day 5
7	MET day 6
8	MET day 7
9	MET day 8
10	IMCS status word (MET day 0 - 8)

A table of contents listing of each "tar file" of the DAT tape is also included in this package.

Further Information

To request copies of relevant WUPPE documents, preprints/reprints, bibliography, or general questions, please contact Marilyn Meade at the UW Space Astronomy Laboratory, Chamberlin Hall, 1150 University Avenue, Madison, WI 53706, telephone (608) 263-4678, or by email at meade@sal.wisc.edu or MADRAF::MEADE.

Astro-01A

WUPPE Data Archive
Level 0 Raw Spectrometer Data FITS files

24 February 1993

by Marilyn R. Meade

o Description of the Instrument

The Wisconsin Ultraviolet Photo-Polarimeter Experiment (WUPPE) is one of three ultraviolet telescopes on the ASTRO-1 payload which flew aboard the space shuttle Columbia during a nine day mission in December 1990. WUPPE is a 0.5m f/10 Cassegrain telescope and spectropolarimeter. It obtained simultaneous spectra and polarization measurements, with a spectral resolution of about 10A, from 1400 to 3200A. A set of halfwave plates at 6 different angles provide spectropolarimetric modulation with 10A resolution on point sources through apertures from 6 to 40 arcsec. A "Lyot" analyzer is used to provide 50-100A spectropolarimetric resolution on faint point targets and diffuse nebulae. The typical diffuse object aperture was 3x50 arcsec. Calibrations of instrumental polarimetric efficiency, residual polarization, position angle registration, and flux sensitivity were performed by a combination of preflight laboratory measures and in-flight standard star observations. The data are corrected for telemetry errors, thermal background, cosmic ray hits, second order contamination, pointing errors, and instrumental polarization, which is roughly 0.05%.

o Level 0 Data

Level 0 data products include field and zoom camera images, spectrometer scans and housekeeping (General Measurement Loop (GML)) data. The WUPPE data have been stripped from the Goddard SpaceLab Data Processing Facility (SLDPF) tapes. The individual field, zoom, GML and spectrometer files from the tapes were combined to form one file of each type of data for each 12 hour time slice of the mission.

The raw spectrometer data consists of all the spectrometer data taken by WUPPE during the mission. This includes instrument background (standby) scans and scans taken while observing a science target. When the frametime of a scan is greater than 1 second, WUPPE also reads out a redundant scan in addition to the prime scan readout. Each scan is composed of 2048 16-bit integers (two arrays-A and B). Each 12 hour time slice of data contains thousands of raw spectrometer scans.

o Caution to Users

The WUPPE level 0 spectrometer data should be used with caution. There are several known problems with the data that were dealt with in the data reduction procedure. Bad scans were identified and not used. There were randomly occuring telemetry errors in the data stream. The data could be trashed completely, could have negative values and the low byte could get stuck at 255.

There were also Analog/Digital errors which resulted in dropped bits. The redundant scan (when it existed) was used to help identify and fix the bad pixels.

Level 0 Raw Spectrometer Data FITS File naming convention

There are 10 WUPPE raw spectrometer scans in one level 0 raw spectrometer data FITS file.

The files are named as follows:

DAYxxSCANmmmm.FITS

where

xx is the MET day number times 10 (00,05,10,...,80) (on unix, the files were 0.0,0.5,1.0...but VMS will not accept the extra ".")

mmmm is the beginning raw scan number from the original (12-hour time slice) spectrometer file.

For example, FITS file "DAY05SCAN0001.FITS" contains raw scans 1 through 10 from day 0.5. "DAY05SCAN0011.FITS" contains raw scans 11 through 20 from day0.5.

o Description of WUPPE Raw Spectrometer Data FITS files and Sample Files

DAY05SAMP0001.FITS and DAY05SAMP0011.FITS have been copied into

MADRAF::MEADE:[MEADE.LEVEL0.SPEC]

They were written on a digital DECstation 5000/240 using DEC Fortran for Ultrix RISC Systems, running Ultrix 4.2. We used the FITSIO package, version 3.2, written by William Pence at the Goddard Spaceflight Center.

Each file is 60480 bytes in length (119 VMS blocks).

The set of basic header information includes the primary array keywords and keywords describing the instrument and data arrays and 16 keywords describing the telescope observational and engineering data for each of the 10 raw scans in the FITS file.

The sample files include the following comment records to distinguish them from the actual data files:

```
COMMENT   This is a sample Level 0 WUPPE Spectrometer
COMMENT   FITS file. Data are not to be distributed.
```

The headers of the sample files are given below.

Each raw spectrometer data array data consists of 1024x2 integer*2 words. The FITS file then contains 1024x2x10 integer*2 arrays. If there were not enough scans to complete a 10 scan FITS file zero-filled were written to the FITS file. In addition, if the data in the original 12 hour time slice file were so corrupted as to be unreadable, a FILLER scan was written in its place. The second sample file (DAY05SAMP0011.FITS) shows examples of FILLER scans.

o FITS file header

```
 FITS file = DAY05SAMP0001.FITS

SIMPLE  =                    T / file does conform to FITS standard
BITPIX  =                   16 / number of bits per data pixel
NAXIS   =                    3 / number of data axes
NAXIS1  =                 1024 / length of data axis   1
NAXIS2  =                    2 / length of data axis   2
NAXIS3  =                   10 / length of data axis   3
COMMENT   Each raw scan has 1024x2 data points
COMMENT   There are 10 raw scans in each FITS file
CTYPE1  = 'Pixel   '             / Pixel Number
CRPIX1  =                  1.0 / Starting pixel number
CRVAL1  =               5893.0 / Starting pixel value
CDELT1  =                  1.0 / Delta pixel number
CTYPE2  = 'Row     '             / Row Number
CRPIX2  =                  1.0 / Starting row number
CRVAL2  =               5893.0 / Starting row value
CDELT2  =                  1.0 / Delta row number
COMMENT   Row 1=A array counts per frame
COMMENT   Row 2=B array counts per frame
CTYPE3  = 'Scan No.'             / Scan Number
CRPIX3  =                  1.0 / Starting scan number
CRVAL3  =                  1.0 / Starting scan value
CDELT3  =                  1.0 / Delta scan number
ORIGIN  = 'UW-Space Astronomy Lab' / Creator of FITS file
DATE    = 'Tue Feb 23 19:15:09 1993' / Date FITS file was created
OBSERVAT= 'ASTRO-1 '             / Observatory
TELESCOP= 'WUPPE   '             / Telescope
INSTRUME= 'SPECTROPOLARIMETER' / Instrument Used
SCANUM01=                    1 / Raw Scan Number
CURSEQ01=                    0 / Current Sequence Number
STATUS01= '9: STB  '             / Instrument Status Mode
FRMTIM01=                 0.20 / Frametime for the scan (seconds)
APER01  =                    1 / Aperture Used
FILT01  =                    6 / Filter Used
GMTTIM01= '336/20:59:59'         / GMT stop time of data readout
METTIM01= '0/14:10:58'           / MET stop time of data readout
SAT01   =                  0.0 / %Saturation
AVESIG01=                -25.3 / Average Signal ((A+B)/2)
BOS01   =                 -6.8 / Bright Object Sensor reading
THERM01 =                -20.1 / Instrument temperature (Centigrade)
SAAFLG01=                    0 / South Atlantic Anomaly status
IMCS01  =                    0 / IMCS status
QUAL01  =                    0 / SLDPF Quality Flag (max)
SCAN01  = 'PRIME SCAN'           / Prime or Redundant Scan
SCANUM02=                    2 / Raw Scan Number
CURSEQ02=                    0 / Current Sequence Number
STATUS02= '9: STB  '             / Instrument Status Mode
FRMTIM02=                 0.20 / Frametime for the scan (seconds)
APER02  =                    1 / Aperture Used
FILT02  =                    6 / Filter Used
GMTTIM02= '336/21: 0: 0'         / GMT stop time of data readout
METTIM02= '0/14:10:59'           / MET stop time of data readout
SAT02   =                  0.0 / %Saturation
AVESIG02=                -25.7 / Average Signal ((A+B)/2)
BOS02   =                 -6.8 / Bright Object Sensor reading
THERM02 =                -20.1 / Instrument temperature (Centigrade)
SAAFLG02=                    0 / South Atlantic Anomaly status
IMCS02  =                    0 / IMCS status
```

```
QUAL02  =                    0 / SLDPF Quality Flag (max)
SCAN02  = 'PRIME SCAN'         / Prime or Redundant Scan
SCANUM03=                    3 / Raw Scan Number
CURSEQ03=                    0 / Current Sequence Number
STATUS03= '9: STB  '           / Instrument Status Mode
FRMTIM03=                 0.50 / Frametime for the scan (seconds)
APER03  =                    1 / Aperture Used
FILT03  =                    6 / Filter Used
GMTTIM03= '336/21: 0: 2'       / GMT stop time of data readout
METTIM03= '0/14:11: 1'         / MET stop time of data readout
SAT03   =                  3.5 / %Saturation
AVESIG03=                 14.4 / Average Signal ((A+B)/2)
BOS03   =                 -6.8 / Bright Object Sensor reading
THERM03 =                -20.1 / Instrument temperature (Centigrade)
SAAFLG03=                    0 / South Atlantic Anomaly status
IMCS03  =                    0 / IMCS status
QUAL03  =                    0 / SLDPF Quality Flag (max)
SCAN03  = 'PRIME SCAN'         / Prime or Redundant Scan
SCANUM04=                    4 / Raw Scan Number
CURSEQ04=                    0 / Current Sequence Number
STATUS04= '9: STB  '           / Instrument Status Mode
FRMTIM04=                 0.50 / Frametime for the scan (seconds)
APER04  =                    1 / Aperture Used
FILT04  =                    6 / Filter Used
GMTTIM04= '336/21: 0: 3'       / GMT stop time of data readout
METTIM04= '0/14:11: 2'         / MET stop time of data readout
SAT04   =                  3.5 / %Saturation
AVESIG04=                 13.7 / Average Signal ((A+B)/2)
BOS04   =                 -6.8 / Bright Object Sensor reading
THERM04 =                -20.1 / Instrument temperature (Centigrade)
SAAFLG04=                    0 / South Atlantic Anomaly status
IMCS04  =                    0 / IMCS status
QUAL04  =                    0 / SLDPF Quality Flag (max)
SCAN04  = 'PRIME SCAN'         / Prime or Redundant Scan
SCANUM05=                    5 / Raw Scan Number
CURSEQ05=                    0 / Current Sequence Number
STATUS05= '9: STB  '           / Instrument Status Mode
FRMTIM05=                 2.00 / Frametime for the scan (seconds)
APER05  =                    1 / Aperture Used
FILT05  =                    6 / Filter Used
GMTTIM05= '336/21: 0: 6'       / GMT stop time of data readout
METTIM05= '0/14:11: 5'         / MET stop time of data readout
SAT05   =                 15.2 / %Saturation
AVESIG05=                443.5 / Average Signal ((A+B)/2)
BOS05   =                 -6.8 / Bright Object Sensor reading
THERM05 =                -20.1 / Instrument temperature (Centigrade)
SAAFLG05=                    0 / South Atlantic Anomaly status
IMCS05  =                    0 / IMCS status
QUAL05  =                    0 / SLDPF Quality Flag (max)
SCAN05  = 'PRIME SCAN'         / Prime or Redundant Scan
SCANUM06=                    6 / Raw Scan Number
CURSEQ06=                    0 / Current Sequence Number
STATUS06= '9: STB  '           / Instrument Status Mode
FRMTIM06=                 2.00 / Frametime for the scan (seconds)
APER06  =                    1 / Aperture Used
FILT06  =                    6 / Filter Used
GMTTIM06= '336/21: 0: 7'       / GMT stop time of data readout
METTIM06= '0/14:11: 6'         / MET stop time of data readout
SAT06   =                 15.2 / %Saturation
```

```
AVESIG06=                443.5 / Average Signal ((A+B)/2)
BOS06   =                 -6.8 / Bright Object Sensor reading
THERM06 =                -20.1 / Instrument temperature (Centigrade)
SAAFLG06=                    0 / South Atlantic Anomaly status
IMCS06  =                    0 / IMCS status
QUAL06  =                    0 / SLDPF Quality Flag (max)
SCAN06  = 'REDUNDANT SCAN'     / Prime or Redundant Scan
SCANUM07=                    7 / Raw Scan Number
CURSEQ07=                    0 / Current Sequence Number
STATUS07= '9: STB  '           / Instrument Status Mode
FRMTIM07=                 2.00 / Frametime for the scan (seconds)
APER07  =                    1 / Aperture Used
FILT07  =                    6 / Filter Used
GMTTIM07= '336/21: 0: 9'       / GMT stop time of data readout
METTIM07= '0/14:11: 8'         / MET stop time of data readout
SAT07   =                 15.2 / %Saturation
AVESIG07=                434.7 / Average Signal ((A+B)/2)
BOS07   =                 -6.8 / Bright Object Sensor reading
THERM07 =                -20.1 / Instrument temperature (Centigrade)
SAAFLG07=                    0 / South Atlantic Anomaly status
IMCS07  =                    0 / IMCS status
QUAL07  =                    0 / SLDPF Quality Flag (max)
SCAN07  = 'PRIME SCAN'         / Prime or Redundant Scan
SCANUM08=                    8 / Raw Scan Number
CURSEQ08=                    0 / Current Sequence Number
STATUS08= '9: STB  '           / Instrument Status Mode
FRMTIM08=                 2.00 / Frametime for the scan (seconds)
APER08  =                    1 / Aperture Used
FILT08  =                    6 / Filter Used
GMTTIM08= '336/21: 0:10'       / GMT stop time of data readout
METTIM08= '0/14:11: 9'         / MET stop time of data readout
SAT08   =                 15.2 / %Saturation
AVESIG08=                434.7 / Average Signal ((A+B)/2)
BOS08   =                 -6.8 / Bright Object Sensor reading
THERM08 =                -20.1 / Instrument temperature (Centigrade)
SAAFLG08=                    0 / South Atlantic Anomaly status
IMCS08  =                    0 / IMCS status
QUAL08  =                    0 / SLDPF Quality Flag (max)
SCAN08  = 'REDUNDANT SCAN'     / Prime or Redundant Scan
SCANUM09=                    9 / Raw Scan Number
CURSEQ09=                    0 / Current Sequence Number
STATUS09= '9: STB  '           / Instrument Status Mode
FRMTIM09=                 2.00 / Frametime for the scan (seconds)
APER09  =                    1 / Aperture Used
FILT09  =                    6 / Filter Used
GMTTIM09= '336/21: 0:11'       / GMT stop time of data readout
METTIM09= '0/14:11:10'         / MET stop time of data readout
SAT09   =                 15.2 / %Saturation
AVESIG09=                426.4 / Average Signal ((A+B)/2)
BOS09   =                 -6.8 / Bright Object Sensor reading
THERM09 =                -20.1 / Instrument temperature (Centigrade)
SAAFLG09=                    0 / South Atlantic Anomaly status
IMCS09  =                    0 / IMCS status
QUAL09  =                    0 / SLDPF Quality Flag (max)
SCAN09  = 'PRIME SCAN'         / Prime or Redundant Scan
SCANUM10=                   10 / Raw Scan Number
CURSEQ10=                    0 / Current Sequence Number
STATUS10= '9: STB  '           / Instrument Status Mode
FRMTIM10=                 2.00 / Frametime for the scan (seconds)
```

```
APER10  =                    1 / Aperture Used
FILT10  =                    6 / Filter Used
GMTTIM10= '336/21: 0:12'       / GMT stop time of data readout
METTIM10= '0/14:11:11'         / MET stop time of data readout
SAT10   =                 15.2 / %Saturation
AVESIG10=                426.4 / Average Signal ((A+B)/2)
BOS10   =                 -6.8 / Bright Object Sensor reading
THERM10 =                -20.1 / Instrument temperature (Centigrade)
SAAFLG10=                    0 / South Atlantic Anomaly status
IMCS10  =                    0 / IMCS status
QUAL10  =                    0 / SLDPF Quality Flag (max)
SCAN10  = 'REDUNDANT SCAN'     / Prime or Redundant Scan
COMMENT   This is a sample Level 0 WUPPE Spectrometer
COMMENT   FITS file. Data are not to be distributed.
```

FITS file = DAY05SAMP0011.FITS (note that the last 2 scans in the file are filler scans.)
(Abbreviated header, to save space)

```
SIMPLE  =                    T / file does conform to FITS standard
BITPIX  =                   16 / number of bits per data pixel
NAXIS   =                    3 / number of data axes
NAXIS1  =                 1024 / length of data axis   1
NAXIS2  =                    2 / length of data axis   2
NAXIS3  =                   10 / length of data axis   3
COMMENT   Each raw scan has 1024x2 data points
COMMENT   There are 10 raw scans in each FITS file
CTYPE1  = 'Pixel   '           / Pixel Number
CRPIX1  =                  1.0 / Starting pixel number
CRVAL1  =               5893.0 / Starting pixel value
CDELT1  =                  1.0 / Delta pixel number
CTYPE2  = 'Row     '           / Row Number
CRPIX2  =                  1.0 / Starting row number
CRVAL2  =               5893.0 / Starting row value
CDELT2  =                  1.0 / Delta row number
COMMENT   Row 1=A array counts per frame
COMMENT   Row 2=B array counts per frame
CTYPE3  = 'Scan No.'           / Scan Number
CRPIX3  =                  1.0 / Starting scan number
CRVAL3  =                  1.0 / Starting scan value
CDELT3  =                  1.0 / Delta scan number
ORIGIN  = 'UW-Space Astronomy Lab' / Creator of FITS file
DATE    = 'Tue Feb 23 19:15:09 1993' / Date FITS file was created
OBSERVAT= 'ASTRO-1 '           / Observatory
TELESCOP= 'WUPPE   '           / Telescope
INSTRUME= 'SPECTROPOLARIMETER' / Instrument Used
SCANUM01=                   11 / Raw Scan Number
CURSEQ01=                    0 / Current Sequence Number
STATUS01= '9: STB  '           / Instrument Status Mode
FRMTIM01=                 2.00 / Frametime for the scan (seconds)
APER01  =                    1 / Aperture Used
FILT01  =                    6 / Filter Used
GMTTIM01= '336/21: 0:13'       / GMT stop time of data readout
METTIM01= '0/14:11:12'         / MET stop time of data readout
SAT01   =                 14.5 / %Saturation
AVESIG01=                418.3 / Average Signal ((A+B)/2)
BOS01   =                 -6.8 / Bright Object Sensor reading
THERM01 =                -20.1 / Instrument temperature (Centigrade)
SAAFLG01=                    0 / South Atlantic Anomaly status
```

```
IMCS01  =                    0 / IMCS status
QUAL01  =                    0 / SLDPF Quality Flag (max)
SCAN01  = 'PRIME SCAN'         / Prime or Redundant Scan
SCANUM02=                   12 / Raw Scan Number
CURSEQ02=                    0 / Current Sequence Number
STATUS02= '9: STB  '           / Instrument Status Mode
FRMTIM02=                 2.00 / Frametime for the scan (seconds)
APER02  =                    1 / Aperture Used
FILT02  =                    6 / Filter Used
GMTTIM02= '336/21: 0:14'       / GMT stop time of data readout
METTIM02= '0/14:11:13'         / MET stop time of data readout
SAT02   =                 14.5 / %Saturation
AVESIG02=                418.3 / Average Signal ((A+B)/2)
BOS02   =                 -6.8 / Bright Object Sensor reading
THERM02 =                -20.1 / Instrument temperature (Centigrade)
SAAFLG02=                    0 / South Atlantic Anomaly status
IMCS02  =                    0 / IMCS status
QUAL02  =                    0 / SLDPF Quality Flag (max)
SCAN02  = 'REDUNDANT SCAN'     / Prime or Redundant Scan
    .
    .
    .
SCANUM08=                   18 / Raw Scan Number
CURSEQ08=                    0 / Current Sequence Number
STATUS08= '9: STB  '           / Instrument Status Mode
FRMTIM08=                 2.00 / Frametime for the scan (seconds)
APER08  =                    1 / Aperture Used
FILT08  =                    6 / Filter Used
GMTTIM08= '336/21: 0:20'       / GMT stop time of data readout
METTIM08= '0/14:11:19'         / MET stop time of data readout
SAT08   =                 14.5 / %Saturation
AVESIG08=                395.2 / Average Signal ((A+B)/2)
BOS08   =                 -6.8 / Bright Object Sensor reading
THERM08 =                -20.1 / Instrument temperature (Centigrade)
SAAFLG08=                    0 / South Atlantic Anomaly status
IMCS08  =                    0 / IMCS status
QUAL08  =                    0 / SLDPF Quality Flag (max)
SCAN08  = 'REDUNDANT SCAN'     / Prime or Redundant Scan
SCANUM09=                   19 / Raw Scan Number
CURSEQ09=                    0 / Current Sequence Number
STATUS09= '0:      '           / Instrument Status Mode
FRMTIM09=                 0.00 / Frametime for the scan (seconds)
APER09  =                    0 / Aperture Used
FILT09  =                    0 / Filter Used
GMTTIM09= '0/ 0: 0: 0'         / GMT stop time of data readout
METTIM09= '0/ 0: 0: 0'         / MET stop time of data readout
SAT09   =                  0.0 / %Saturation
AVESIG09=                  0.0 / Average Signal ((A+B)/2)
BOS09   =                  0.0 / Bright Object Sensor reading
THERM09 =                  0.0 / Instrument temperature (Centigrade)
SAAFLG09=                    0 / South Atlantic Anomaly status
IMCS09  =                    0 / IMCS status
QUAL09  =                    0 / SLDPF Quality Flag (max)
SCAN09  = 'FILLER SCAN'        / Zero-Filled Scan
SCANUM10=                   20 / Raw Scan Number
CURSEQ10=                    0 / Current Sequence Number
STATUS10= '0:      '           / Instrument Status Mode
FRMTIM10=                 0.00 / Frametime for the scan (seconds)
APER10  =                    0 / Aperture Used
```

```
FILT10  =                    0 / Filter Used
GMTTIM10= '0/ 0: 0: 0'         / GMT stop time of data readout
METTIM10= '0/ 0: 0: 0'         / MET stop time of data readout
SAT10   =                  0.0 / %Saturation
AVESIG10=                  0.0 / Average Signal ((A+B)/2)
BOS10   =                  0.0 / Bright Object Sensor reading
THERM10 =                  0.0 / Instrument temperature (Centigrade)
SAAFLG10=                    0 / South Atlantic Anomaly status
IMCS10  =                    0 / IMCS status
QUAL10  =                    0 / SLDPF Quality Flag (max)
SCAN10  = 'FILLER SCAN'        / Zero-Filled Scan
COMMENT   This is a sample Level 0 WUPPE Spectrometer
COMMENT   FITS file. Data are not to be distributed.
```

o File verification

The program "specfitsread.f" was written to verify the contents of the sample Level 0 Spectrometer FITS files. It also uses the GSFC FITSIO software package. The program is provided here along with the ASCII output files from this program ("day05samp0001.dump" and "day05samp0011.dump") for the 2 sample Level 0 FITS file .

o The complete data set

The entire set of FITS files have been written to a DAT tape by the unix "tar" command. There are approximately 7400 (450 Megabytes total) WUPPE Level 0 spectrometer data FITS files, each with 10 raw scans. There are 17 "tar" files on this DAT tape. Each of the "tar" files contains the WUPPE level 0 spectrometer data for a 12 hour time slice of the mission. A table of contents listing for each "tar" file of the DAT tape is also included in this package.

tar file #	contents	# FITS files/"tar" file
1	day0.0	256
2	day0.5	224
3	day1.0	498
4	day1.5	622
5	day2.0	461
6	day2.5	288
7	day3.0	201
8	day3.5	529
9	day4.0	339
10	day4.5	528
11	day5.0	726
12	day5.5	389
13	day6.0	797
14	day6.5	412
15	day7.0	360
16	day7.5	465
17	day8.0	327

o Further Information

To request copies of relevant WUPPE documents, preprints/reprints, bibliography, or general questions, please contact Marilyn Meade at the UW Space Astronomy Laboratory, Chamberlin Hall, 1150 University Avenue, Madison, WI 53706, telephone (608) 263-4678, or by email at

meade@sal.wisc.edu or MADRAF::MEADE.

WUPPE Data Archive
Level 0 Raw Spectrometer Data FITS files
Data Ordered By ID/Object

4 May 1993

by Marilyn R. Meade

o Description of the Instrument

The Wisconsin Ultraviolet Photo-Polarimeter Experiment (WUPPE) is one of three ultraviolet telescopes on the ASTRO-1 payload which flew aboard the space shuttle Columbia during a nine day mission in December 1990. WUPPE is a 0.5m f/10 Cassegrain telescope and spectropolarimeter. It obtained simultaneous spectra and polarization measurements, with a spectral resolution of about 10A, from 1400 to 3200A. A set of halfwave plates at 6 different angles provide spectropolarimetric modulation with 10A resolution on point sources through apertures from 6 to 40 arcsec. A "Lyot" analyzer is used to provide 50-100A spectropolarimetric resolution on faint point targets and diffuse nebulae. The typical diffuse object aperture was 3x50 arcsec. Calibrations of instrumental polarimetric efficiency, residual polarization, position angle registration, and flux sensitivity were performed by a combination of preflight laboratory measures and in-flight standard star observations. The data are corrected for telemetry errors, thermal background, cosmic ray hits, second order contamination, pointing errors, and instrumental polarization, which is roughly 0.05%.

o Level 0 Data

Level 0 data products include field and zoom camera images, spectrometer scans and housekeeping (General Measurement Loop (GML)) data. The WUPPE data have been stripped from the Goddard SpaceLab Data Processing Facility (SLDPF) tapes. The individual field, zoom, GML and spectrometer files from the tapes were combined to form one file of each type of data for each 12 hour time slice of the mission.

The raw spectrometer data consists of all the spectrometer data taken by WUPPE during the mission. This includes instrument background (standby) scans and scans taken while observing a science target. When the frametime of a scan is greater than 1 second, WUPPE also reads out a redundant scan in addition to the prime scan readout. Each scan is composed of 2048 16-bit integers (two arrays-A and B). Each 12 hour time slice of data contains thousands of raw spectrometer scans.

The entire mission raw spectrometer files were delivered previously. The data set delivered here includes only the raw spectrometer data taken during observations of science targets and the relevant background and offset scans taken before and after the observations.

o Caution to Users

The WUPPE level 0 spectrometer data should be used with caution. There are several known problems with the data that were dealt with in the data reduction procedure. Bad scans were identified and not used. There were randomly occuring telemetry errors in the data stream. The data could be trashed completely, could have negative values and the low byte could get stuck at 255. There were also Analog/Digital errors which resulted in dropped bits. The redundant scan (when it existed) was used to help identify and fix the bad pixels.

o Level 0 Raw Spectrometer Data FITS File naming convention

There are 10 WUPPE raw spectrometer scans in one level 0 raw spectrometer data FITS file.

The files are named as follows:

TARGET-ID_MTL-NAME_Smmmm.fits (e.g. 0010-14_BD284211_S0001.fits)

where

TARGET-ID is the object identification number assigned during the mission. Each Shuttle pointing had a unique Target ID.
MTL-NAME is the Mission Target List name.
S denotes Spectrometer data
mmmm is the beginning raw scan number of the FITS file

For example, FITS file "0010-14_BD284211_S0001.fits" contains raw scans 1 through 10 that pertain to the 0010-14 observation of BD+28 4211. File "0010-14_BD284211_S0011.fits" contains raw scans 11 through 20.

o Description of WUPPE Raw Spectrometer Data FITS files

The FITS files were written on a digital DECstation 5000/240 using DEC FORTRAN for Ultrix RISC Systems, running Ultrix 4.2. We used the FITSIO package, version 3.2, written by William Pence at the Goddard Spaceflight Center.

Each file is 60480 bytes in length (119 VMS blocks).

The set of basic header information includes the primary array keywords and keywords describing the instrument and data arrays and 16 keywords describing the telescope observational and engineering data for each of the 10 raw scans in the FITS file.

An example header of a FITS file is given below.

Each raw spectrometer scan consists of 1024x2 integer*2 words. The FITS file then contains 1024x2x10 integer*2 arrays. If there were not enough scans to complete a 10 scan FITS file, zero-filled data (a FILLER scan) were written to the FITS file. In addition, if the data in the original 12 hour time slice were so badly corrupted as to be unreadable, a FILLER scan was written in its place.

FITS file header

FITS file = 0010-14_BD284211_S0001.fits

```
SIMPLE  =                    T / file does conform to FITS standard
BITPIX  =                   16 / number of bits per data pixel
NAXIS   =                    3 / number of data axes
NAXIS1  =                 1024 / length of data axis   1
NAXIS2  =                    2 / length of data axis   2
NAXIS3  =                   10 / length of data axis   3
COMMENT   Each raw scan has 1024x2 data points
COMMENT   There are 10 raw scans in each FITS file
CTYPE1  = 'Pixel   '             / Pixel Number
CRPIX1  =                  1.0 / Starting pixel number
CRVAL1  =               5893.0 / Starting pixel value
CDELT1  =                  1.0 / Delta pixel number
CTYPE2  = 'Row     '             / Row Number
CRPIX2  =                  1.0 / Starting row number
CRVAL2  =               5893.0 / Starting row value
CDELT2  =                  1.0 / Delta row number
COMMENT   Row 1=A array counts per frame
COMMENT   Row 2=B array counts per frame
CTYPE3  = 'Scan No.'             / Scan Number
CRPIX3  =                  1.0 / Starting scan number
CRVAL3  =                  1.0 / Starting scan value
CDELT3  =                  1.0 / Delta scan number
ORIGIN  = 'UW-Space Astronomy Lab' / Creator of FITS file
DATE    = 'Thu Mar 25 15:33:44 1993' / Date FITS file was created
OBSERVAT= 'ASTRO-1 '             / Observatory
TELESCOP= 'WUPPE   '             / Telescope
INSTRUME= 'SPECTROPOLARIMETER' / Instrument Used
OBJECT  = 'BD284211'             / Object Observed
ID      = '0010-14 '             / Target ID
PRIME   = 'HUT     '             / Prime Instrument
EQUINOX =               1950.00 / Equinox for coordinates
RA      =             327.2391 / Right ascension in degrees
DEC     =              28.6261 / Declination in degrees
GMTSTART= '342/20:39:56'         / GMT start time of observation (incl. bkgs)
GMTSTOP = '342/21:09:21'         / GMT stop time of observation (incl. bkgs)
METSTART= '6/13:50:55'           / Mission Elapsed Time start time (incl. bkgs)
METSTOP = '6/14:20:20'           / Mission Elapsed Time stop time (incl. bkgs)
SCANUM01=                    1 / Raw Scan Number
CURSEQ01=                  342 / Current Sequence Number
STATUS01= '9: STB  '             / Instrument Status Mode
FRMTIM01=                 4.00 / Frametime for the scan (seconds)
APER01  =                    1 / Aperture Used
FILT01  =                    4 / Filter Used
GMTTIM01= '342/20:39:56'         / GMT stop time of data readout
METTIM01= '6/13:50:55'           / MET stop time of data readout
SAT01   =                  2.3 / %Saturation
AVESIG01=                 68.6 / Average Signal ((A+B)/2)
BOS01   =                 -2.4 / Bright Object Sensor reading
THERM01 =                -34.1 / Instrument temperature (Centigrade)
SAAFLG01=                    0 / South Atlantic Anomaly status
IMCS01  =                  255 / IMCS status
QUAL01  =                    0 / SLDPF Quality Flag (max)
SCAN01  = 'PRIME SCAN'           / Prime or Redundant Scan
SCANUM02=                    2 / Raw Scan Number
CURSEQ02=                  342 / Current Sequence Number
STATUS02= '9: STB  '             / Instrument Status Mode
FRMTIM02=                 4.00 / Frametime for the scan (seconds)
APER02  =                    1 / Aperture Used
FILT02  =                    4 / Filter Used
```

```
GMTTIM02= '342/20:39:57'        / GMT stop time of data readout
METTIM02= '6/13:50:56'          / MET stop time of data readout
SAT02   =                   2.3 / %Saturation
AVESIG02=                  68.6 / Average Signal ((A+B)/2)
BOS02   =                  -2.2 / Bright Object Sensor reading
THERM02 =                 -34.1 / Instrument temperature (Centigrade)
SAAFLG02=                     0 / South Atlantic Anomaly status
IMCS02  =                   255 / IMCS status
QUAL02  =                     0 / SLDPF Quality Flag (max)
SCAN02  = 'REDUNDANT SCAN'      / Prime or Redundant Scan
SCANUM03=                     3 / Raw Scan Number
CURSEQ03=                   342 / Current Sequence Number
STATUS03= '9: STB  '            / Instrument Status Mode
FRMTIM03=                  4.00 / Frametime for the scan (seconds)
APER03  =                     1 / Aperture Used
FILT03  =                     4 / Filter Used
GMTTIM03= '342/20:40: 0'        / GMT stop time of data readout
METTIM03= '6/13:50:59'          / MET stop time of data readout
SAT03   =                   2.3 / %Saturation
AVESIG03=                  68.7 / Average Signal ((A+B)/2)
BOS03   =                  -2.2 / Bright Object Sensor reading
THERM03 =                 -34.1 / Instrument temperature (Centigrade)
SAAFLG03=                     0 / South Atlantic Anomaly status
IMCS03  =                   255 / IMCS status
QUAL03  =                     0 / SLDPF Quality Flag (max)
SCAN03  = 'PRIME SCAN'          / Prime or Redundant Scan
SCANUM04=                     4 / Raw Scan Number
CURSEQ04=                   342 / Current Sequence Number
STATUS04= '9: STB  '            / Instrument Status Mode
FRMTIM04=                  4.00 / Frametime for the scan (seconds)
APER04  =                     1 / Aperture Used
FILT04  =                     4 / Filter Used
GMTTIM04= '342/20:40: 1'        / GMT stop time of data readout
METTIM04= '6/13:51: 0'          / MET stop time of data readout
SAT04   =                   2.3 / %Saturation
AVESIG04=                  68.7 / Average Signal ((A+B)/2)
BOS04   =                  -2.1 / Bright Object Sensor reading
THERM04 =                 -34.1 / Instrument temperature (Centigrade)
SAAFLG04=                     0 / South Atlantic Anomaly status
IMCS04  =                   255 / IMCS status
QUAL04  =                     0 / SLDPF Quality Flag (max)
SCAN04  = 'REDUNDANT SCAN'      / Prime or Redundant Scan
SCANUM05=                     5 / Raw Scan Number
CURSEQ05=                   342 / Current Sequence Number
STATUS05= '9: STB  '            / Instrument Status Mode
FRMTIM05=                  4.00 / Frametime for the scan (seconds)
APER05  =                     1 / Aperture Used
FILT05  =                     4 / Filter Used
GMTTIM05= '342/20:40: 4'        / GMT stop time of data readout
METTIM05= '6/13:51: 3'          / MET stop time of data readout
SAT05   =                   2.3 / %Saturation
AVESIG05=                  68.7 / Average Signal ((A+B)/2)
BOS05   =                  -2.1 / Bright Object Sensor reading
THERM05 =                 -34.1 / Instrument temperature (Centigrade)
SAAFLG05=                     0 / South Atlantic Anomaly status
IMCS05  =                   255 / IMCS status
QUAL05  =                     0 / SLDPF Quality Flag (max)
SCAN05  = 'PRIME SCAN'          / Prime or Redundant Scan
SCANUM06=                     6 / Raw Scan Number
```

```
CURSEQ06=                   342 / Current Sequence Number
STATUS06= '9: STB  '            / Instrument Status Mode
FRMTIM06=                  4.00 / Frametime for the scan (seconds)
APER06  =                     1 / Aperture Used
FILT06  =                     4 / Filter Used
GMTTIM06= '342/20:40: 5'        / GMT stop time of data readout
METTIM06= '6/13:51: 4'          / MET stop time of data readout
SAT06   =                   2.3 / %Saturation
AVESIG06=                  68.7 / Average Signal ((A+B)/2)
BOS06   =                  -2.2 / Bright Object Sensor reading
THERM06 =                 -34.2 / Instrument temperature (Centigrade)
SAAFLG06=                     0 / South Atlantic Anomaly status
IMCS06  =                   255 / IMCS status
QUAL06  =                     0 / SLDPF Quality Flag (max)
SCAN06  = 'REDUNDANT SCAN'      / Prime or Redundant Scan
SCANUM07=                     7 / Raw Scan Number
CURSEQ07=                   342 / Current Sequence Number
STATUS07= '9: STB  '            / Instrument Status Mode
FRMTIM07=                  4.00 / Frametime for the scan (seconds)
APER07  =                     1 / Aperture Used
FILT07  =                     4 / Filter Used
GMTTIM07= '342/20:40: 8'        / GMT stop time of data readout
METTIM07= '6/13:51: 7'          / MET stop time of data readout
SAT07   =                   2.3 / %Saturation
AVESIG07=                  68.7 / Average Signal ((A+B)/2)
BOS07   =                  -2.2 / Bright Object Sensor reading
THERM07 =                 -34.1 / Instrument temperature (Centigrade)
SAAFLG07=                     0 / South Atlantic Anomaly status
IMCS07  =                   255 / IMCS status
QUAL07  =                     0 / SLDPF Quality Flag (max)
SCAN07  = 'PRIME SCAN'          / Prime or Redundant Scan
SCANUM08=                     8 / Raw Scan Number
CURSEQ08=                   342 / Current Sequence Number
STATUS08= '9: STB  '            / Instrument Status Mode
FRMTIM08=                  4.00 / Frametime for the scan (seconds)
APER08  =                     1 / Aperture Used
FILT08  =                     4 / Filter Used
GMTTIM08= '342/20:40: 9'        / GMT stop time of data readout
METTIM08= '6/13:51: 8'          / MET stop time of data readout
SAT08   =                   2.3 / %Saturation
AVESIG08=                  68.7 / Average Signal ((A+B)/2)
BOS08   =                  -2.1 / Bright Object Sensor reading
THERM08 =                 -34.1 / Instrument temperature (Centigrade)
SAAFLG08=                     0 / South Atlantic Anomaly status
IMCS08  =                   255 / IMCS status
QUAL08  =                     0 / SLDPF Quality Flag (max)
SCAN08  = 'REDUNDANT SCAN'      / Prime or Redundant Scan
SCANUM09=                     9 / Raw Scan Number
CURSEQ09=                   342 / Current Sequence Number
STATUS09= '9: STB  '            / Instrument Status Mode
FRMTIM09=                  4.00 / Frametime for the scan (seconds)
APER09  =                     1 / Aperture Used
FILT09  =                     4 / Filter Used
GMTTIM09= '342/20:40:12'        / GMT stop time of data readout
METTIM09= '6/13:51:11'          / MET stop time of data readout
SAT09   =                   2.3 / %Saturation
AVESIG09=                  68.6 / Average Signal ((A+B)/2)
BOS09   =                  -2.2 / Bright Object Sensor reading
THERM09 =                 -34.1 / Instrument temperature (Centigrade)
```

```
SAAFLG09=                    0 / South Atlantic Anomaly status
IMCS09  =                  255 / IMCS status
QUAL09  =                    0 / SLDPF Quality Flag (max)
SCAN09  = 'PRIME SCAN'         / Prime or Redundant Scan
SCANUM10=                   10 / Raw Scan Number
CURSEQ10=                  342 / Current Sequence Number
STATUS10= '9: STB  '           / Instrument Status Mode
FRMTIM10=                 4.00 / Frametime for the scan (seconds)
APER10  =                    1 / Aperture Used
FILT10  =                    4 / Filter Used
GMTTIM10= '342/20:40:13'       / GMT stop time of data readout
METTIM10= '6/13:51:12'         / MET stop time of data readout
SAT10   =                  2.3 / %Saturation
AVESIG10=                 68.6 / Average Signal ((A+B)/2)
BOS10   =                 -2.2 / Bright Object Sensor reading
THERM10 =                -34.1 / Instrument temperature (Centigrade)
SAAFLG10=                    0 / South Atlantic Anomaly status
IMCS10  =                  255 / IMCS status
QUAL10  =                    0 / SLDPF Quality Flag (max)
SCAN10  = 'REDUNDANT SCAN'     / Prime or Redundant Scan
```

o File verification

The program "specfitsread.f" was written to verify the contents of the sample Level 0 Spectrometer FITS files. It also uses the GSFC FITSIO software package. The program is provided here along with the ASCII output from this program ("0010-14_BD284211_S0001.dump") for the example Level 0 FITS file .

o The complete data set

The entire set of FITS files by ID/object have been written to a DAT tape by the unix "tar" command. There are approximately 4200 (251 Megabytes total) WUPPE Level 0 spectrometer data FITS files, each with 10 raw scans. There are 14 "tar" files on this DAT tape. 8 of these "tar" files contain the spectrometer data discussed in this document. A table of contents listing for each "tar" file of the DAT tape is also included in this package.

tar file #	contents (by target ID number)
6	001*.fits,0658*.fits
7	0606*.fits,1*.fits
8	2102*.fits,2107*.fits,2122*.fits,2133*.fits
9	2109*.fits,2209*.fits
10	2217*.fits,2235*.fits,23*.fits
11	24*.fits,25*.fits,26*.fits,28*.fits
12	3*.fits,41*.fits,42*.fits,44*.fits,450*.fits,451*.fits
13	453*.fits,455*.fits,5*.fits,6*.fits,7*.fits,8*.fits,9*.fits

(You may wonder how this division of files came about. There were so many files, "tar" gave a "too many arguments" message. So, I kept cutting down in what I was trying to write to tape until it stopped complaining.)

o Further Information

To request copies of relevant WUPPE documents, preprints/reprints,

bibliography, or general questions, please contact Marilyn Meade at the UW Space Astronomy Laboratory, Chamberlin Hall, 1150 University Avenue, Madison, WI 53706, telephone (608) 263-4678, or by email at meade@sal.wisc.edu or MADRAF::MEADE.

From: NCF::ARCHIVES "NDADS Automated Retrieval Mail System" 4-DEC-1996 0
To: ALOPEZ
CC:
Subj: NDADS Automated Retrieval Mail System Information

AVAILABLE WUPPE HOLDINGS
(Revised August 9, 1996)

The NDADS holdings for WUPPE include the following datasets: The Level 1 (processed and calibrated) spectropolarimetry data; The Level 0 (raw) spectrometer SCAN data; The Level 0 Zero-Order Detector (ZOD) Camera data. The ZOD data come in three image forms: ZOOM, FIELD and DOWNFIELD data; and the Engineering PostScript data files. The WUPPE Level 0 spectrometer, Level 1 spectropolarimetry and the ZOD data are archived in FITS format. At the time of writing, the Level 1 halfwave spectropolarimetry data and the Engineering PostScript data files were being loaded to NDADS but the Lyot data had not yet been delivered to NDADS.

1.0 REQUESTS FOR ASTRO-1/WUPPE DATA FROM NDADS

1.1 Detailed Formats:

NDADS requests for WUPPE data should use the following Data-Types and Entry-ID's. Generally multiple files are returned for a given Data-Type and Entry-ID request. The Project-ID is WUPPE.

DATA-TYPES:

HALFWAVE_FITS - Level 1 Spectropolarimeter Halfwave filter FITS data (NA)
HALFWAVE_PS - Level 1 Spectropolarimeter Halfwave filter Postscript plot files (NA)
HALFWAVE_ASCII- Level 1 Spectropolarimeter Halfwave filter ASCII dumps FITS files. (NA)
HALFWAVE - Level 1 Spectropolarimeter Halfwave filter data - (FITS + Postscript plots + ASCII dumps) (NA)
LYOT2 - Level 1 Spectropolarimeter Medium Resolution Lyot filter (NA) FITS data
LYOT4 - Level 1 Spectropolarimeter Low Resolution Lyot filter (NA) FITS data
SCAN - Level 0 SCAN spectrometer FITS data
ZOOM - Level 0 Zero order detector ZOOM FITS data files
DOWNFIELD - Level 0 Zero order detector DOWNFIELD FITS data files
FIELD - Level 0 Zero order detector FIELD FITS data files
ENG_A - General Measurement Loop (GML) Analog Engineering postscript plot files. (NA)
ENG_D - General Measurement Loop (GML) Digital Engineering postscript plot files. (NA)
ENG_M - General Measurement Loop (GML) Serial Msg #1 Engineering postscript plot files. (NA)
ENG_IS - Image Motion Control (IMC) Status flag Engineering postscript plot files. (NA)
ENG - All engineering (GML + IMCS) data postscript files (NA)
ALL - All WUPPE data for a given Entry-ID
DOCUMENT - Various ascii document files (NA)
SOFTWARE - Various F77 programs to read the WUPPE Astro-1 data files. (NA)

Note: NA = Not Currently Available on NDADS

WUPPE/NDADS ENTRY-ID's for ZOD Camera and Spectrometer Data:

Some of the WUPPE data-sets are available ordered by the Mission Elapsed Time (MET) Day number and some of the data-sets are available ordered by the Astro-1 pointing id and/or the object name.

DAYyz - WUPPE data ordered by Mission Elapsed Time (MET) Day Number times 10 (eg. 00, 05, 10,... 80). Files are grouped into 12-hour periods for each DAYyz (MET time of y.z) starting from the launch GMT of 1990, day 336/06:49:01. For example, entry id's of DAY00 will retrieve files containing data with a MET time of 0 day, 00h:00m:00s to 11h:59m:59m; DAY05 will retrieve files from day 0, 12h:00m:00s to 23h:59m:59s, etc. The ZOOM, DOWNFIELD, SCAN, FIELD and ENG (ENG_A, ENG_D, ENG_M, and ENG_IS) data-types can be ordered by the MET DAYyz Entry-ID.

OBJECTID - The Object-ID is a 3 to 8 alpha-numeric character name for the Object. It comes from the Mission Target List name. The names are common to the HUT, UIT and WUPPE instruments. The number of characters in OBJECT can vary from 3 to 8 characters. May be a mix of numbers and/or alphabetic information. The OBJECT-ID should be left justified with no imbedded blanks, and may contain imbedded '-'s. The HALFWAVE (HALFWAVE_FITS, HALFWAVE_PS, and HALFWAVE_ASCII), SCAN, ZOOM, DOWNFIELD, and FIELD data-types can be ordered by the OBJECTID.

PPPPPP - The Pointing_ID is a 6 digit number which represents the object identification number which was assigned during the ASTRO1 mission. Each shuttle pointing had a unique Pointing_ID number. There may be several Pointings of a single Object. The HALFWAVE (HALFWAVE_FITS, HALFWAVE_PS, and HALFWAVE_ASCII), SCAN, ZOOM, DOWNFIELD, and FIELD data-types can be ordered by the Pointing-ID (PPPPPP).

WUPPE Astro-1 DOCUMENTs (Data-type=DOCUMENT):

All documentation is in ASCII format.

Entry-ID	File Name	Contents
GENINFO	WUPPE1_GENINFO.DOC	General Information
OBSLOG	WUPPE1_OBSLOG.DOC	Observing Log
HALFWAVE	WUPPE1_HALFWAVE.DOC	Halfwave Data Documentation
SCAN	WUPPE1_SCAN.DOC	SCAN Data Documentation
ZOOM	WUPPE1_ZOOM.DOC	ZOOM Data Documentation
DOWNFIELD	WUPPE1_DOWNFIELD.DOC	DOWNFIELD Data Documentation
FIELD	WUPPE1_FIELD.DOC	FIELD Data Documentation
ENGINEERING	WUPPE1_ENGINEERING.DOC	Engineering Data Documentation
DOC_ALL	WUPPE1_*.DOC	Retrieves all of the document files

WUPPE Astro-1 SOFTWARE (Data-type = SOFTWARE):

All software is Fortran and uses FITSIO 3.2. It was written with DEC fortran for ULTRIX RISC Systems (Ultrix 4.2) and is F77. Software files are available from NDADS.

Entry-ID	File Name		Program purpose
SPECFITSREAD	SPECFITSREAD.F	-	Read FITS header and primary data array of the Level 0 spectrometer (SCAN) data.
ZOOMFITSREAD	ZOOMFITSREAD.F	-	Read FITS header and primary data array of the Level 0 ZOD Zoom camera data.
HWFITSREAD	HWFITSREAD.F	-	Read FITS header, primary data array (flux), and Binary table extension (%Q, %U, and error) of the Level 1 Halfwave Filter Spectropolarimetry data
FLUXFITSREAD	FLUXFITSREAD.F	-	Read FITS header and primary data array (flux) of the Level 1 Halfwave Filter Spectropolarimetry data
DFLDFITSREAD	DFLDFITSREAD.F	-	Read FITS header and primary data array of the Level 0 ZOD Downfield camera data.
FLDFITSREAD	FLDFITSREAD.F	-	Read FITS header and primary data array of the Level 0 ZOD Field camera data.
SOFTWARE_ALL	*.F	-	All of the above programs.

Information on the FITSIO software package can be obtained at the WWW URL:

http://heasarc.gsfc.nasa.gov/docs/heasarc/ofwg/fits.html

1.2 WUPPE Spectrometer and ZOD Data File Names

All Astro 1 / WUPPE file names on NDADS begin with "WUPPE1". WUPPE1 file names have one of 4 extensions; .FITS for FITS files, .PS for PostScript files, .FOR for Fortran 77 programs, and .DOC for ASCII document files. WUPPE file names are organized in two ways. One dataset is organized by the Object-ID and the file names contain both the Object-ID and the 6-digit Pointing-ID (pppppp). A second dataset is organized by the Mission elapsed time (MET) day number, which is contained within the file name. All FITS files have the Data-Type encoded within the file name. In the sample file names below the following conventions are used:

1.2.1 Level 1 Spectropolarimeter data

```
WUPPE1_OBJECTID_PPPPPP_HW.FITS      Data-type = HALFWAVE_FITS
WUPPE1_OBJECTID_PPPPPP_HW.PS        Data-type = HALFWAVE_PS
WUPPE1_OBJECTID_PPPPPP_HW.DUMP      Data-type = HALFWAVE_ASCII

Samples:
WUPPE1_ALF-CAM_210720_HW.FITS
WUPPE1_HD25443_065823_HW.PS
```

1.2.2 Level 0 SCAN Spectrometer data (Data-type=SCAN):

```
WUPPE1_DAYyz_SN_nnnn.FITS
WUPPE1_OBJECTID_PPPPPP_SN_nnnn.FITS
```

Samples:
WUPPE1_BD284211_001014_SN_0001.FITS
WUPPE1_DAY05_SN_0001.FITS

nnnn = 4 digit starting SCAN number

1.2.3 Level 0 Zero Order Detector (ZOD) ZOOM Data (Data-type=ZOOM):

WUPPE1_DAYyz_ZM_nnnn.FITS
WUPPE1_OBJECTID_PPPPPP_ZM_nnnn.FITS

Sample Files:
WUPPE1_DAY05_ZM_0001.FITS
WUPPE1_BD284211_001014_ZM_nnnn.FITS
WUPPE1_C-LEVY_111230_ZM_0001.FITS

nnnn = 4 digit starting ZOOM Image number

1.2.4 Level 0 ZOD DOWNFIELD Data (Data-type=DOWNFIELD):

WUPPE1_DAYyz_DN_n.FITS
WUPPE1_OBJECTID_PPPPPP_DN_n.FITS

Sample Files:
WUPPE1_NGC1068_820333_DN_1.FITS

n = 1 digit DOWNFIELD Image Number

2.5 Level 0 ZOD FIELD data (Data-types = Field):

WUPPE1_DAYyz_FD_nnnnn.FITS
WUPPE1_OBJECTID_PPPPPP_FD_nnnnn.FITS

Sample Files:
WUPPE1_DAY55_FD_00081.FITS
WUPPE1_NGC4151_FD_00081.FITS

nnnnn = 5 digit FIELD Starting Image Number

1.2.6 GML Engineering data (Data-types = ENG_A, ENG_D, ENG_M):

WUPPE1_DAYyz_EG_cnn.PS
WUPPE1_OBJECTID_PPPPPP_EG_cnn.PS

Sample Files:
WUPPE1_DAY70_EG_A01.PS -> WUPPE1_DAY70_EG_A40.PS
WUPPE1_DAY70_EG_M01.PS -> WUPPE1_DAY70_EG_M40.PS
WUPPE1_DAY70_EG_D01.PS -> WUPPE1_DAY70_EG_D46.PS

WUPPE1_G70D8247_260911_EG_A01.PS -> WUPPE1_G70D8247_260911_EG_A40.PS

cnn = 1 character + 2 digit number indicating which engineering value is contained in the file. Analog data = A01 -> A32; Serial Message data = M01 ->M40; Digital Data = D01 -> D46.

1.2.7 Image Motion Compensation System (IMCS) data (Data-type=ENG_IS):

WUPPE1_DAYyz_ISTATUS.PS (Only available ordered by DAYyz)

1.3 Sample WUPPE NDADS Data Request:

3.1 POLARIZATION DATA :

An example of a request for all Level 1 Halfwave data obtained of ALF-CAM, would be:

subject: REQUEST WUPPE HALFWAVE

Enter in the body of the mail message:

ALF-CAM

Sample file names returned:

WUPPE1_ALF-CAM_*_HW.FITS
WUPPE1_ALF-CAM_*_HW.PS
WUPPE1_ALF-CAM_*_HW.DUMP

1.3.2 SCAN DATA:

An example of a request for all WUPPE SCAN data obtained on DAY 0.5, all SCAN data with an Object-ID of BD284211, and all SCAN data with a Pointing-ID of 065823, would be:

subject: REQUEST WUPPE SCAN

Enter in the body of the mail message:

DAY05
BD284211
065823

Sample file names returned:

WUPPE1_DAY05_SN_*.FITS
WUPPE1_BD284211_*_SN_*.FITS
WUPPE1_*_065823_SN_*.FITS

2.0 ADDITIONAL INFORMATION

Additional information on the WUPPE/Astro-1 data archives on NDADS can be found at the World Wide Web URL:

http://ndads.gsfc.nasa.gov/astro1/wuppe/wuppe.html

2.1 WUPPE (NSSDC-ID = Astro 1-01):

The Wisconsin Ultraviolet Photo-Polarimeter Experiment (WUPPE) was one of three ultraviolet telescopes on the ASTRO-1 payload which flew aboard the space shuttle Columbia during a nine day mission in December 1990 (December 2 through 11). The Wisconsin Ultraviolet Photo Polarimeter Experiment (WUPPE) was designed to measure the polarization of light in the ultraviolet. WUPPE was a 0.5m f/10 Cassegrain telescope and spectropolarimeter. The WUPPE spectrometer was a modified Monk-Gilleson spectrometer: a plane grating is placed between a spherical relay mirror

and the detector. WUPPE obtained simultaneous spectra and polarization measurements, with a spectral resolution of about 10A, from 1400 to 3300A. A set of halfwave plates at 6 different angles provided spectropolarimetric modulation with 10A resolution on point sources through apertures from 6 to 40 arcsec. A "Lyot" analyzer was used to provide 50-100A spectropolarimetric resolution on faint point targets and diffuse nebulae. Field identification, offsetting, focussing, and pointing trim were accomplished by relaying the zero-order image of the Wisconsin Ultraviolet Photo Polarimeter Experiment (WUPPE) spectrometer grating to a blue-sensitive zero-order detector (ZOD) CCD camera.

2.2 WUPPE LEVEL 0 SPECTROMETER DATA (NSSDC-ID = ASTRO 1-01A):

The level 0 spectropolarimeter data consists of all the spectropolarimeter data taken by WUPPE during the mission. This includes instrument background (standby) scans and scans taken while observing a science target. When the frametime (exposure time) of a scan was greater than 1 second, WUPPE also read out a redundant scan in addition to the prime scan readout. Each scan is composed of 2048 16-bit integers (two arrays-A and B). The Level 0 Spectropolarimeter data are available in two forms. One set is organized by Mission Elapsed Time (MET) day number and a second set is organized by Object ID. Each 12 hour time slice of data contained thousands of raw spectropolarimeter scans. The spectropolarimetry data are archived in FITS format.

2.3 WUPPE LEVEL 1 SPECTROPOLARIMETER DATA (NSSDC-ID = ASTRO 1-01B):

Level 1 data products include calibrated spectra and polarizations of approximately 75 targets, about 25 of which are WUPPE prime targets. Some objects have multiple pointings. The data have been processed using methods developed for the ground-based spectropolarimetric data from the Pine Bluff Observatory (PBO) of the University of Wisconsin. Calibrations of instrumental polarimetric efficiency, residual polarization, position angle registration, and flux sensitivity were performed by a combination of preflight laboratory measures and in-flight standard star observations. The Level 1 data are corrected for telemetry errors, thermal background, cosmic ray hits, second order contamination, pointing errors, and instrumental polarization, which is roughly 0.05%. For halfwave mode (HW) data, the filters are differenced and a Fourier analysis pixel-by-pixel as a function of filter angle is done to give Stokes parameters %Q and %U spectra along with a %Error spectra, all consisting of 1024 data points for each array from about 1400 to 3200A. For Lyot (L2 and L4) data, the two detector arrays are normalized to a flat spectrum, differenced, and analyzing the resulting Fourier pattern in wavelength gives Stokes %Q, %U, %V and %Error spectra in 64 individual bins or less. The halfwave and Lyot filter data also contain the flux calibrated spectra (ergs/cm**2/sec/Angstrom) consisting of 1024 data points.

2.4 WUPPE ZERO ORDER DETECTOR (NSSDC-ID = ASTRO 1-01C):

Field identification, offsetting, focussing, and pointing trim were accomplished by relaying the zero-order image of the Wisconsin Ultraviolet Photo Polarimeter Experiment (WUPPE) spectrometer grating to a blue-sensitive zero-order detector (ZOD) camera. The ZOD was an intensified RCA 320x512 two-dimensional CCD array. The intensifier was an ITT 18 mm proximity-focussed channel intensifier with P-20 phosphor,

quartz faceplate, and S-20 photocathode for blue-sensitivity. The array was uncooled and typically read out every second. There are three types of ZOD data; field, zoom and downfield images. No calibrations have been applied to the ZOD images and thus it is Level 0 data. The individual ZOD images are archived in FITS format. The field mode was used for identification and acquisition of the targets. Its size was 3.3 x 4.4 arcmin, 320 x 256 pixels using a 1-bit display. The zoom mode was used for fine pointing and focus. The size of the zoom image was 24 x 32 arcsec, 30 x 40 pixels using a 6-bit grey scale display. The downfield data is similar to the field data except it used the 6-bit grey scale display and was used to produce a more detailed picture of the field around the object of interest.

2.5 WUPPE ENGINEERING DATA (NSSDC-ID = ASTRO 1-01D):

Level 0 Engineering data products consist of the engineering/ housekeeping (General Measurement Loop (GML)) data. The WUPPE data have been stripped from the Goddard SpaceLab Data Processing Facility (SLDPF) tapes. Engineering/Operational data plots have been made for 118 values contained in the WUPPE GML. These data were read out every second and include such information as temperatures, gains, voltages, currents, apertures and filters selected, pitch and yaw offsets, door and motor positions and various other hardware and software values. Plots are provided in standard PostScript format and contain engineering data from Serial Message number 1, Analog data and Digital data. The WUPPE1 engineering data is available in two forms. One set is organized by the Mission Elapsed Time (MET) day number and the second is organized by the Object ID. The engineering dataset, organized by MET day number, contains one plot per GML value for each 12 hour time slice (18 plots for the entire mission for each of the 118 values, about 2100 plot files in all). The engineering dataset, organized by Object ID, contains one plot per GML parameter for each target observation. The IMCS (Image Motion Control Status) word plots are also available in similar 12-hour time slices. These data were derived from the IMCS SLDPF tapes (IMCS Status Word). Also available are overlays for each time slice which show when (and which) targets were observed by WUPPE. These overlays are on the same scale as the engineering data organized by MET day number.

2.6 WUPPE OPERATIONS MANUAL

The WUPPE Operations Requirements/Procedures Manual - Volume 1 is available on microfiche upon request from the NSSDC Coordinated Request and User Support Services Office (CRUSO). Ask for document TRF B43054.

3.0 INFORMATION CONTACTS

If you have any questions or need further assistance, please call or write to:

NSSDC/CRUSO
NASA/Goddard Space Flight Center
Code 633.4
Greenbelt, Maryland 20771

Phone Number: 301-286-6695
NSI-DECnet: NSSDCA::REQUEST
NSI: request@nssdca.gsfc.nasa.gov

or

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or

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NSI: meade@sal.wisc.edu
NSI-DECnet: MADRAF::MEADE

From: NCF::ARCHIVES "NDADS Automated Retrieval Mail System" 4-DEC-1996 0
To: ALOPEZ
CC:
Subj: NDADS Automated Retrieval Mail System Information

GENERAL NDADS HOLDINGS INFORMATION
(revised October 28, 1996:NAO)

This document contains a summary of the various data-sets contained on the National Aeronautics and Space Administration (NASA) Data Archive and Distribution Service (NDADS). The NDADS archive currently contains 1.7 TerraBytes of astrophysics and space physics data from 31 projects. New data are being added on a daily basis. NDADS data sets can be stored on several types of media (currently two WORM optical disk jukeboxes and in the near future a CDROM jukebox). The NDADS archive is sponsored by the Space Science Data Operations Office (SSDOO, Code 630) at the NASA Goddard Space Flight Center (GSFC).

For specific information on any of the projects described below, please request the NDADS holdings file by sending an e-mail message to the ARCHIVES account on the NDADS cluster. On the subject line of the mail message enter the phrase 'HOLDINGS' followed by the specific project name. The specific project names as given in the dataset summary below must be used. An example is shown below.

DECnet: To: NDADS::ARCHIVES
Subject: HOLDINGS HEAO3

-or-

Internet: To: archives@ndads.gsfc.nasa.gov
Subject: HOLDINGS HEAO3

The allowed project names are: ADC, ASCA, BBXRT, CGRO_EGRET, Copernicus, DE, GINGA, HAWKEYE, HEAO1, HEAO2, HEAO3, HST, HUT, IMP8, IRAS, ISEE1, ISEE2, ISEE3, ISIS, ISTP, IUE, NRAO, Mariner10, OGLE, ORFEUS, PIONEER, ROSAT, SAMPEX, SANMARCO, SKYLAB, UIT, ULYSSES, VELA5B, WIND, WUPPE, and YOHKOH.

Key space physics datasets available include:

o DE-1 SAI auroral UV/visible image data (3-12 min), telem. & s/w	1981-87
o DE-1 RIMS 1/64-s ion data, mission analysis files and software	1981-89
o DE-1 EICS 1/32-s energetic(<17keV) ion data, SATF files and s/w	1981-91
o DE-1 EICS 96-sec average energetic H+, O+, He+ fluxes, CDF	1981-91
o DE-1 PWI 1/16-s plasma wave data and software (extract&calib.)	1981-84
o DE-1 HAPI 1/64-s plasma data (5-32keV), telemetry files and s/w	1981
o DE-2 DUCT total ion concentration - 64 times per second, ASCII	1981-83
o DE-2 MAG-B 1/16-s magnetometer data (binary) in GMS coordinates	1981-83
o DE-2 MAG-B 1/16-s data (binary) in s/c coord, also 1/2-s ASCII	1981-83
o DE-2 VEFI 1/16-s electric field data (binary), also 1/2-s ASCII	1981-83
o DE-2 LAPI high res. plasma data (5-32keV), telemetry and s/w	1981-83
o DE-2 Unified Abstract (UA) 16-s thermal plasma data, ASCII	1981-83
o DE-2 LANG 1/2-s plasma densities & temperatures, ASCII	1981-83
o DE-2 NACS 1-s neutral densities (O, N2, He, N, Ar), ASCII	1981-83
o DE-2 IDM 1/4-s ion drift (horizontal&vertical), ASCII	1981-83

o DE-2 RPA 2-s ion densities, temp., drift (line-of-sight), ASCII	1981-83
o IMP-8 magnetometer data, 15sec resolution, ASCII and binary	1973-
o IMP-8 magnetometer data, 1min resolution	1991-
o IMP-8 plasma parameter data, 2min res.	1973-92
o ISEE-1 fluxgate magnetometer data	1977-87
o ISEE-1 solar wind ion moments, crossed-fan analyzer data	1977-83
o ISEE-2 fluxgate magnetometer data	1977-87
o ISEE-3 helium vector magnetometer data, 1-min res.	1978-90
o ISEE-3 solar wind electron moments, 168-second and 1-hour averages	1980-92
o ISIS 1/2 Electron Densities, ASCII	1969-80
o ISTP key parameter data	1992-
o Hawkeye magnetic field, plasma, and wave data	1974-78
o Mariner 10 magnetometer data, 42-s resolution, cruise	1973-74
o Pioneer 10&11 interplan. magnetic field data, 1min & 1hr res.	1972-94
o SAMPEX 30-s fluxes and rates ASCII	1992-93
o San Marco IVI 10-s ion densities, temperature & drift, ASCII	1988
o Skylab X-ray images	1973-74
o Ulysses interplan. magnetic field, plasma, & radio data, ASCII	1990-95
o Wind Waves Daily PostScript Spectrograms	1994-
o YOHKOH solar X-ray and gamma-ray data	1991-

Key Astrophysics datasets available include:

o International Ultraviolet Explorer (IUE), IUESIPS and final archive versions	1978-
o ROSAT X-ray Observations, Position Sensitive Proportional Counter and High Resolution Imager	1990-
o IRAS Sky Survey Atlas, Faint Source Survey and other products	1983
o Ginga (large Area Counter X-ray data)	1987-91
o VELA5B data, Cosmic X-ray all-sky survey data	1969-?
o HEAO-1 A-2 Cosmic X-ray Experiment Data	1977-79
o HEAO-2 (Einstein), Imaging Proportional Counter, High Resolution Imager and Solid State Spectrometer data	1978-81
o HEAO-3, all-sky germanium gamma-ray spectrometer data	1979-81
o NRAO CD-ROM data	
o OAO-3 (Copernicus) UV Spectral Atlas	1972-82
o OGLE, sample set CCD detector images	1992-
o Astronomical Data Center (ADC) Source Catalogs	
o WUPPE data, ASTRO-1 Space Shuttle mission, December	1990
o BBXRT data, ASTRO-1 Space Shuttle mission, December	1990
o ASCA (Advanced Satellite for Cosmology and Astrophysics) data	1993-
o Compton Gamma Ray Observatory, Energetic Gamma Ray Experiment Telescope data	1991-
o Hubble Space Telescope Data (HST) - EO data only	1990
o HUT data, ASTRO-1 Space Shuttle mission, December	1990
o UIT data, ASTRO-1 Space Shuttle mission, December	1990
o ORFEUS-SPAS I EUV data	1993

NDADS Project Dataset Summaries

ADC:

The Astronomical Data Center (ADC) archive on NDADS consists of catalogs and tables of astronomical data in computer-readable format. The catalogs contain astrometry, photometry, spectroscopy, radio and other miscellaneous data for

both stellar and nonstellar objects. Most of the catalogs and documentation are archived in ASCII format. In some cases the catalogs may be archived in FITS format.

ASCA:

The Advanced Satellite for Cosmology and Astrophysics (ASCA) was launched on February 20, 1993. The objective of ASCA is to perform spectroscopic X-ray astronomy in the wavelength band 1 to 12 keV. ASCA also has an imaging capability. ASCA is a joint Japanese and US mission. ASCA carries four identical X-ray telescopes with two CCD-based detectors (SIS) and two gas imaging scintillation proportional counters (GIS). The ASCA NDADS archive consists of data from the first 8-month Performance Verification period and from the Guest Observer phase of the mission. ASCA data is stored on NDADS in TAR format by observation and datatype.

BBXRT:

The BBXRT experiment was an X-ray telescope on the ASTRO-1 payload which flew aboard the space shuttle Columbia during a nine day mission in December 1990 (December 2 through 11). BBXRT was sensitive between 0.3-12 keV with a moderate energy resolution (typically 90 eV and 150 eV at 1 and 6 keV, respectively). The NDADS data holdings for BBXRT include the following datasets: target, slew and calibration interval data (photon event list, housekeeping data, mission quality information, pointing information); target light curve; target and background spectra; spectral response matrix and documentation. All BBXRT data products, except the documentation, are archived in FITS format. The NDADS BBXRT HOLDINGS file contains a copy of the BBXRT Observation Catalog.

CGRO_EGRET:

The Compton Gamma Ray Observatory (CGRO) is the second of NASA's Great Observatories and was launched on April 5, 1991. Compton carries 4 instruments that cover the electromagmetic spectrum from 30 keV to 30 GeV. The CGRO NDADS archive contains data from the Energetic Gamma Ray Experiment Telescope (EGRET) which is sensitive between 20 MeV to 30 GeV. EGRET is a pictorial-type telescope using a digitized spark chamber to identify the electron pair produced by a gamma-ray interaction, and a large NaI(Tl) scintillator crystal to determine the gamma-ray energy of astronomical sources. The NDADS holdings for CGRO EGRET include the following datasets: the map files for each pointing (counts, exposure and intensity) and the event list and exposure history in the Rationalized Data Format (RDF) (the HEASARC format). All these files are in FITS format. Most data from the first two cycles of CGRO observations are currently available.

Copernicus:

The Third Orbiting Astronomical Observatory (OAO-3; now called Copernicus) was the first major orbiting UV spectroscopic mission, which covered the wavelength range from 910 to 3200 A. Copernicus observed primarily bright, early-type stars (V<6.5) at high resolution (~20,000). Copernicus was designed for high-resolution studies of absorption lines in the interstellar medium and obtained data from August 26, 1972 through February 17, 1982. The NDADS Copernicus Ultraviolet Spectral Atlas data was obtained from tapes originally created at Princeton University Observatory. The NDADS Copernicus data is raw data in native format.

DE:

The two Dynamics Explorer spacecraft were launched on 3 August 1981 into coplanar polar orbits at different altitudes for the purpose of studying interactive processes within the atmosphere-ionosphere-magnetosphere system. DE , with an altitude range of 300 km to 1000 km, re-entered the atmosphere on February 19, 1983. DE 1 had an altitude range of 570 km to 23 000 km (3.63 Earth radii) and its operations ceased in January 1991.

Instruments on board the spin-stabilized DE 1 were: the spin-scan auroral imager (SAI), energetic ion composition spectrometer (EICS), high altitude plasma instrument (HAPI), magnetometer (MAG-A), plasma wave instrument (PWI), and retarding ion mass spectrometer (RIMS).

Instruments on board the three-axis stabilized DE 2 were: magnetometer (MAG-B), vector electric field instrument (VEFI), ion drift meter (IDM), low altitude plasma instrument (LAPI), Langmuir probe instrument (LANG), retarding potential analyzer (RPA), wind and temperature spectrometer (WATS), Fabry-Perot interferometer (FPI), and neutral atmosphere composition spectrometer (NACS).

The DE-1 data on NDADS consist in most cases of the PI-provided telemetry-level data and software (to calibrate the data and to extract higher level data products). The DE-2 data on NDADS consist mostly of the instrument-specific geophysical parameters in ASCII format. The ASCII files were generated at NSSDC using the PI-provided telemetry-level data and software.

GINGA:

GINGA is the third Japanese X-ray astronomy satellite, formerly known as ASTRO-C. "Ginga" is the Japanese word for galaxy. GINGA was launched on February 5, 1987 and in operation until November 1, 1991. It carried three detectors, the Large Area Counter (LAC), the All-Sky Monitor (ASM) and the Gamma-ray Detector (GBD). The LAC is the main instrument. With its large effective area (4,000 cm**2) and low internal background, the LAC is the most sensitive detector in the energy range 2-30 keV flown on board an orbiting satellite to date. The set of LAC data files on NDADS contains quick-look data dumps of all the LAC observations. The files are records that contain uncorrected broad-band count rates in one of three telemetry time intervals. Ginga data is available in native format.

HAWKEYE:

The Hawkeye spacecraft (Explorer 52) carried a payload of 3 scientific instruments: a plasma wave receiver, fluxgate magnetometer, and a low energy proton-electron differential energy analyzer. It was designed, built and tracked by the University of Iowa. The spacecraft was launched on June 3, 1974 into a polar orbit with initial apogee over the north pole and re-entered on April 28, 1978 after 667 orbits or nearly four years of continuous operation. The spacecraft apogee was between 20.9 and 28.3 Earth radii with less than a 1000 km perigee. The spacecraft was spin stabilized and had a rotational period of approximately 11 seconds. The investigation objectives of the Hawkeye 1 spacecraft were in principle to survey the polar regions (cusp, auroral zone, mantle, bow shock and magnetopause) of the Earth's magnetosphere. The Hawkeye data in NDADS contains data from all 3 instruments over the entire lifetime in master science files.

HEAO1:

The first High Energy Astronomy Observatory (HEAO-1) Cosmic X-Ray Experiment

(A-2) was conducted from August 12, 1977 through January 9, 1979. The experiment consisted of six multi-anode, multi-layer, collimated gas proportional counters, covering the X-ray energy range from 0.25 keV to 60 keV. Each detector scanned a 3-degree wide great circle of the sky each 30 minutes, and covered the full sky in a period of 6 months. The HEAO1 A-2 archive on NDADS contains time-ordered telemetry data and quality flags.

HEAO2:

The second High Energy Astrophysics Observatory (HEAO-2), also named Einstein, was launched on November 13, 1978 and continued to obtain data until April 1981. The NDADS HEAO2 archive consists of data from the Imaging Proportional Counter (IPC) [0.4-4.0 keV] and the High Resolution Imager (HRI) [0.15-3.0 keV]. These are data sets that have been distributed in 8 CD-ROMS to the community, which include the catalog of IPC X-ray sources, the IPC Slew survey, the HRI images, and the HRI event lists. Also available are data from the HEAO2 Solid State Spectrometer (SSS) which was sensitive to X-rays in the range from of 0.5 to 4.5 keV with an energy resolution of 0.160 keV.

HEAO3:

The NDADS HEAO3 data is from the anti-coincidence shield surrounding the germanium gamma-ray spectrometer. These detectors had an energy range of 50 keV to 10 MeV. The shield served as an all-sky monitor for solar flares and cosmic gamma-ray bursts. The data runs from 1979 day 266 through 1981 day 149.

HST:

The NDADS data holdings for the Hubble Space Telescope (HST) contain some of the first results obtained with the Hubble Space Telescope cameras. In addition the Spacecraft closeout pictures of HST are also available. These data were obtained by the Investigation Definition Teams during August 1990 as part of the Science Assessment and Early Release observations.

HUT:

The NDADS holdings for the Hopkins Ultraviolet Telescope (HUT) consist of data from the first ASTRO mission. HUT was one of three ultraviolet telescopes on the ASTRO-1 payload which flew aboard the space shuttle Columbia during a nine day mission in December 1990 (December 2 through 11). HUT obtained observations of a variety of astronomical sources. The wavelength coverage in first order was 840-1850 A with a resolution of about 3 A. The wavelength coverage in second order was 420-925 A with a resolution of about 1.5 A. The NDADS data holdings for HUT consist of 5 min averaged reduced FITS data, reduced FITS data summed over one pointing, and postscript status file information. A TAR file of the HUT IRAF software is also available 'as-is'.

IMP8:

IMP8 (Explorer 50) was launched in October 1973 to measure cosmic rays, energetic solar particles, interplatetary and magnetotail magnetic fields, and plasma. Its apogee and perigee distances were about 40 and 30 earth radii. Its orbital inclinatin varied between 0 deg. and about 55 deg. with a periodicity of several years. The spacecraft was in the solar wind for 7 to 8 days of every 12.5 day orbit. Telemetry coverage was 90% in the early years, but only 50-70% through most of the 1980's. As of March 1993, IMP8 was continuing to provide data from almost all its instruments.

IRAS:

InfraRed Astronomical Satellite (IRAS) was a joint US (NASA), the Netherlands (NIVR), and the United Kingdom (SERC) project. IRAS conducted an all-sky survey at wavelengths ranging from 8 to 120 microns in four broadband photometric channels centered on 12, 25, 60 and 100 microns. IRAS also made pointed observations of selected objects with integration times lasting up to 12 minutes, providing up to a factor of 10 increase in sensitivity relative to that of the survey. The IRAS NDADS archive contains a number of the IRAS catalogs and data products, including the IRAS Sky Survey Atlas (ISSA), the Faint Source Survey (FSS) data, the Point Source Catalog, Low-Resolution Spectrometer Catalog, Pointed Observations (deep-sky grids), etc. Following a 10 month long mission, IRAS exhausted its cryogen and ceased operations on November 21, 1983.

ISEE1:

ISEE1 data available are from the Los Alamos solar wind instrument and from the UCLA fluxgate magnetometer. The spacecraft was in the solar wind for about a six-month season starting in about July of each year. The solar wind density, velocity, temperature, and alpha/proton ratio were obtained for the years 1977 through 1983. The magnetic field vector components and magnitude cover the time period from launch 10/22/77 to 9/26/87. When requesting data via this automated system, be sure not to include a space in the project name ISEE1.

ISEE2:

ISEE2 data available are from the UCLA fluxgate magnetometer. The magnetic field vector components and magnitude cover the time period from launch 10/22/77 to 9/26/87. When requesting data via this automated system, be sure not to include a space in the project name ISEE2.

ISEE3:

ISEE3/ICE data available are from the vector helium magnetometer and from the solar wind plasma instrument. Daily, hourly, and 1-minute averaged magnetic field vectors are available for the period 8/13/78 through 12/31/90. The solar wind plasma data include both 168-second resolution and hourly averages of the electron density, bulk flow speed, and other parameters for the period 2/27/80 through 6/13/92. When requesting data via this automated system, be sure not to include a space in the project name ISEE3.

ISTP:

The ISTP Key Parameters data are preliminary data at approximately 1-minute resolution intended for browse purposes for identification of events. The ISTP project data are available from NDADS/ARMS and are also available through the NSSDC's WWW interface Space Physics Catalog (SPyCAT) at http://nssdc.gsfc.nasa.gov/space/ndads/istp.html. The ISTP Key Parameters data base contains (or will contain) selected representative data from the primary spacecraft Cluster, Equator-S, Geotail, Interball, Polar, SOHO, and Wind. It will also include data from the other spacecraft IMP-8, GOES-6, -7, -8, -9, and four geosychronous satellites (1989-046A, 1990-095A, 1991-080B, and 1994-084A). Also included are the ground-based investigations DARN, Sondrestrom, CANOPUS, GSAME, and the 210 Magnetometer Chain. Data are available from 1992 to the present, and are produced daily and stored in NSSDC's Common Data Format (CDF) using the ISTP/IACG Guidelines.

IUE:

The International Ultraviolet Explorer (IUE) was launched on January 26, 1978 and continues to acquire data. IUE obtained spectroscopic data of many astrophysical sources in the wavelength range from 1150 to 3250 A. IUE operated in either a high (~0.1A) or low (~6A) resolution mode. The IUE data archives on NDADS contain both the IUESIPS processed data and the IUE Final Archive data. IUESIPS data is available in Guest Observer (GO) format with conversion options available for RDAF and GO-SPLIT formats. The IUE final archive data is available in FITS format.

Mariner10:

Mariner 10, launched in 1973, collected data on the interplanetary region between Venus and Mercury in late 1973 and early 1974 prior to its first flyby of Mercury. To this date, this is an area of interplanetary space unstudied by any other mission. Data from the magnetometer (42 s resolution) is available.

NRAO:

The National Radio Astronomers' Observatory (NRAO) Green Bank 1400 MHz sky maps covering the declination band of -5 deg to +82 deg, and the 4.85GHz sky maps covering 0 deg to +75 deg and its associated documentation are available on NDADS.

OGLE:

OGLE (Optical Gravitational Lensing Experiment) is a multi-year ground-based project to search for gravitational microlensing events caused by dark objects in our galaxy (brown dwarfs, planets, MACHOs etc.). Fields in the galactic Bulge are repeatedly imaged with a CCD detector on a 40" telescope to search for variables down to 20 mag. The Bulge images are in the I band with some V band exposures. In addition, there are observations of a few dozen clusters of galaxies searching for type Ia supernovae to determine their frequency in members of these clusters and to check how good as standard candles such supernovae really are. The clusters of galaxies are imaged mostly in the V band. Since the discovery of variable sources is the main goal for both types of targets (Bulge and clusters), there are multiple frames for the each of the fields. See Acta Astronomica vol. 42, p. 253, 1992, for a project description. The data are in FITS format and each file is 8 Mby. The files available on line are a sample of the full data set.

ORFEUS:

ORFEUS, Orbiting Retrievable Far and Extreme Ultraviolet Spectrometers, is a joint NASA - DARA (the German space agency) project. The ORFEUS-SPAS I payload carried three ultraviolet instruments mounted on the free-flying Astro-SPAS module. The reusable Astro-SPAS platform is designed to be deployed from the Space Shuttle cargo bay for up to 2 weeks of free-flying science observations. The ORFEUS-SPAS I mission was flown in September 1993. The mission acquired astronomical data on numerous targets during 5 days of observations. A second, 14 day flight is scheduled for STS-80 in November 1996. The three ORFEUS-SPAS I instruments [Extreme Ultraviolet (EUV) Spectrometer, Far Ultraviolet (FUV) Spectrometer, and Interstellar Medium Absorption Profile Spectrograph (IMAPS)] were designed for astronomical ultraviolet spectroscopy over the wavelength range 400 - 1250 Angstroms. Currently, only EUV data is available on NDADS.

PIONEER:

Pioneer 10 and Pioneer 11 were respectively launched in 1972 and 1973 to explore the interplanetary magnetic field, solar wind plasma, energetic particle, dust, and ultraviolet radiation environment from the orbit of Earth to that of Jupiter and beyond. Having flown by Jupiter (Pioneer 10&11) and Saturn (Pioneer 11 only), these spacecraft are now on solar system escape trajectories allowing exploration of the outer heliosphere and the search for the heliospheric boundaries (e.g., the solar wind termination shock may lie at about 100 A.U. from the Sun). Routine operations and tracking continue for Pioneer 10 but these have ceased for Pioneer 11 as of Sept. 30, 1995 due to insufficient electrical power from the onboard Radioisotope Thermal Generators to run science experiments. NDADS currently holds interplanetary magnetic data at 1-minute and 1-hour resolution in ASCII format from these spacecraft, the data for Pioneer 10 extending only through 1975 due to magnetometer failure. Interplanetary energetic particle data at six-hour resolution are also available from launch through 1994 from the Pioneer 10 and 11 Cosmic Ray Telescope experiments.

ROSAT:

Designed specifically to detect high-energy radiation, ROSAT's telescopes are investigating X-ray and ultraviolet emissions from many astrophysical sources. ROSAT was designed to observe X rays in the range from 0.1 keV to 2 keV, commonly called the low-energy or soft X-ray band. Rosat is a joint German, US and British project. Data from the High Resolution Imager (HRI) and the Position Sensitive Proportional Counter (PSPC) detectors are being archived on NDADS. The HRI and PSPC data were generated with the Rev 0 and Rev 1 ROSAT processing system. Data from the Rev 2 processing system is expected to be delivered to NDADS in 1996. Note that ROSAT also carries a Wide-Field Camera (WFC) which extended the satellite's coverage of extreme ultraviolet wavelengths, 300 to 60 angstroms (0.042 to 0.21 keV). Data from the WFC is not currently being archived on NDADS.

SANMARCO:

The San Marco satellite was launched on March 25, 1988 into an low-inclination (2.9 degrees) orbit with apogee at 614 km and perigee at 260 km. The satellite carried a solar EUV spectrometer (ASSI), a neutral mass spectrometer and wind instrument (WATI), an ion drift meter and retarding potential analyzer (IVI), a vector electric field instrument (EFI), and a drag balance instrument (DBI). All instruments performed well, except for WATI which failed after 20 days. Data are available from launch to re-entry (December 6, 1988). Time resolution is typically a few seconds.

SKYLAB:

The SKYLAB digitized images from the X-Ray telescope, experiment S-054, are now available. The data was taken from May 1973 until February 1974. In total, approximately 32,000 images of the Sun in soft X-rays were made on 70-mm photographic film by the S-054 X-ray Spectrographic Telescope. Approximately 10 percent of these images were digitized by scientists at American Science & Engineering (the instrument's builder), using a microdensitometer. There are data files containing full-sun images (typically 1243 x 1244 pixels or 1400 x 1401 pixels), and data files containing selected parts of the full-sun images, having assorted dimensions. Some of the image files contain results of special investigations, such as energy flux values derived from the film densities. The catalog of available types of images is being compiled.

UIT:

The Ultraviolet Imaging Telescope (UIT) operated from the shuttle bay during the Astro-1 mission, 2-10 December of 1990 (UIT-1), obtaining 211 exposures of 66 astronomical objects and during the Astro-2 mission, 3-17 March, 1995 (UIT-2), obtaining 758 images of 193 targets. At present, only UIT-1 data are publicly available on NDADS. UIT data were obtained with a Near UV camera (1150 < lambda <3500 Angstroms) and a Far UV camera (1150 < lambda < 2000 Angstroms). The cameras had a 40 arcmin diameter field of view and each one had a 6-position filter wheel. The NDADS UIT data holdings consist of raw density images, images which have been flat fielded and linearized, geometrically corrected images rotated so that North is up and East is on the left, compressed images, and aperture and point spread photometry tables. Various documents, processing and analysis software and calibration data files are also available on NDADS.

ULYSSES:

The Ulysses spacecraft is the first man-made object in a heliocentric orbit with a high enough inclination (80 degrees) to allow in situ studies of the polar heliosphere and the solar wind emanating directly out from large dark regions (coronal holes) in the x-ray corona near the solar poles. Launched on October 6, 1990, the Ulysses spacecraft was boosted on a path towards a flyby of Jupiter on February 8, 1992, thereafter traversing the south polar region (above 70 degrees) of the Sun during June - November of 1994 and the northern polar region during June - October of the next year. NDADS currently holds solar wind magnetic field data at 1-minute and hourly resolution from the Magnetometer Experiment (MAG) and plasma data at high and hourly resolution from the Solar Wind Observations Over the Poles (SWOOPS) experiment. Radio and plasma wave data at resolutions of 144 seconds and 10 minutes, as well as daily summary postscript plots, are available from the Unified Radio and Plasma Wave (URAP) experiment. Further details about Ulysses data on NDADS and elsewhere at NSSDC are given in the project holdings file.

VELA5B:

The Vela5B Cosmic X-ray data on NDADS is a position-ordered data set from the all-sky survey conducted by the scintillation X-ray detector in 3 to 12 keV.

WIND:

The Wind spacecraft was launched in November 1994 to monitor plasma, magnetic field, energetic particles and cosmic rays (mainly) in the interplanetary medium. It is to attain 1st-Lagrangian point orbit in early 1997. It carries nine instruments; details can be read through the URL:
http://nssdc.gsfc.nasa.gov/space/istp/wind.html

WUPPE:

The NDADS holdings for Wisconsin Ultraviolet Photo-Polarimeter Experiment (WUPPE) consist of data from the first ASTRO mission. WUPPE was one of three ultraviolet telescopes on the ASTRO-1 payload which flew aboard the space shuttle Columbia during a nine day mission in December 1990 (December 2 through 11). The Wisconsin Ultraviolet Photo Polarimeter Experiment (WUPPE) was designed to measure the polarization of light in the ultraviolet. WUPPE obtained simultaneous spectra and polarization measurements, with a spectral resolution of about 10A, from 1400 to 3300A. The NDADS holdings for WUPPE include the following datasets: The Level 1 (processed and calibrated)

spectropolarimetry data; The Level 0 (raw) spectrometer SCAN data; The Level 0 Zero-Order Detector (ZOD) Camera data. The ZOD data come in three image forms: ZOOM, FIELD and DOWNFIELD data; and the Engineering PostScript data files. The WUPPE Level 0 spectrometer, Level 1 spectropolarimetry and the ZOD data are archived in FITS format. At the time of writing the ingest of the Level 0 WUPPE data was in progress and the Level 1 spectropolarimetry data was expected to be ingested to NDADS in the near future.

YOHKOH:

The objective of Yohkoh (Japanese for "sunbeam", formerly called Solar-A) is to study the high-energy radiations from solar flares (hard and soft X-rays and energetic neutrons) as well as quiet structures and pre-flare conditions. The mission is a successor to Hinotori, a previous Japanese spacecraft flown at the previous solar activity maximum in 1981. Yohkoh is a three-axis stabilized observatory-type satellite in a nearly-circular Earth orbit, carrying four instruments: two imagers and two spectrometers. The imaging instruments have almost full-Sun fields of view, to avoid missing any flares on the visible disk of the Sun. The Hard X-ray Telescope (HXT) is a multi-grid synthesis type with a spatial resolution of 7 arcsec, operating in the 20 - 80 keV range. The SXT uses grazing-incidence optics and achieves 4 arcsec spatial resolution, operating in the 0.1 - 4 keV range and using 1024 x 1024-pixel CCDs. US solar physicists at Lockheed Palo Alto Research Lab. are collaborating in the Soft X-ray Telescope (SXT) production and data analysis. There is also a continuum Wide-Band Spectrometer (WBS) for X-rays and gamma-rays from 3 keV to 20 MeV (also sensitive to neutrons) and a Bragg Crystal Spectrometer (BCS) for the X-ray lines Fe XXV, Fe XXVI, Ca XIX, and S XV. Approximately 50 Mbytes of data are accumulated per day, and stored on an on-board tape recorder with 10.5 Mbyte capacity. The Yohkoh mission is a cooperative mission of Japan, the US, and the UK. Data are continuously being ingested. The earliest data available were obtained September 1, 1991.

FURTHER ASSISTANCE

Coordinated Request User Support Office (CRUSO)
NASA/Goddard Space Flight Center
Code 633
Greenbelt, Maryland 20771

E-mail: request@ncf.gsfc.nasa.gov

-or-

NCF::REQUEST

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Astro-01A & 01C

WUPPE Data Archive
Level 0 Downfield Camera Image Data FITS files
Data by ID/Object

4 May 1993

by Marilyn R. Meade

o Description of the Instrument

The Wisconsin Ultraviolet Photo-Polarimeter Experiment (WUPPE) is one of three ultraviolet telescopes on the ASTRO-1 payload which flew aboard the space shuttle Columbia during a nine day mission in December 1990. WUPPE is a 0.5m f/10 Cassegrain telescope and spectropolarimeter. It obtained simultaneous spectra and polarization measurements, with a spectral resolution of about 10A, from 1400 to 3200A. A set of halfwave plates at 6 different angles provide spectropolarimetric modulation with 10A resolution on point sources through apertures from 6 to 40 arcsec. A "Lyot" analyzer is used to provide 50-100A spectropolarimetric resolution on faint point targets and diffuse nebulae. The typical diffuse object aperture was 3x50 arcsec. Calibrations of instrumental polarimetric efficiency, residual polarization, position angle registration, and flux sensitivity were performed by a combination of preflight laboratory measures and in-flight standard star observations. The data are corrected for telemetry errors, thermal background, cosmic ray hits, second order contamination, pointing errors, and instrumental polarization, which is roughly 0.05%.

o Level 0 Data

Level 0 data products include field and zoom camera images, spectrometer scans and housekeeping (General Measurement Loop (GML)) data. The WUPPE data have been stripped from the Goddard SpaceLab Data Processing Facility (SLDPF) tapes. The individual field, zoom, GML and spectrometer files from the tapes were combined to form one file of each type of data for each 12 hour time slice of the mission.

o Camera Data

The zero order light of the WUPPE spectrometer is diverted to an intensified CCD camera which makes it possible for the experiment team to acquire and guide upon faint targets and targets in crowded fields. There are three camera modes: field, zoom and downfield. The field mode is used for identification and acquisition of the targets. Its size is 3.3 x 4.4 arcmin, 320 x 256 pixels using a 1-bit display. The zoom mode is used for fine pointing and focus. The size of the image is 24 x 32 arcsec, 30 x 40 pixels using a 6-bit grey scale display. The downfield data is similar to the field data except it uses the 6-bit grey scale display and is used to produce a more detailed picture of the field around the object of interest.

The 15 Downfield Images delivered here includes all the downfield

images taken during the mission.

WUPPE Downfields Taken During Astro-1

NAME	ID	P	MET	COMMENTS
U-GEM	3208-11	H	7/22:42:24	
HR1099	3503-11	H	1/15:37:37	
HR1099	3503-11	H	1/15:38:00	
ETA-CARH	4207-11	W	2/22:50:22	
CRABNEB	4414-10	U	3/ 1: 8:06	
M74	6205-10	U	3/20:47:43	
M81	6216-10	U	3/ 3: 6:38	
M81	6216-11	U	8/ 1:39:27	
M82	7205-10	U	4/ 3:10:46	missing one frame
M100	7310-10	U	3/19:51:25	daylight?
NGC2146	7404-11	U	7/23:54:03	
NGC1068	8202-33	H	6/ 2:10:52	
M87	8307-11	U	3/ 6: 8:55	daylight?
0558-504	8407-13	H	3/ 7:44:15	
1700P64	8415-13	H	3/22:16:32	missing two frames

o Level 0 Downfield Camera Data FITS File naming convention

There is one WUPPE Downfield Image per FITS file.

The files are named as follows:

TARGET-ID_MTL-NAME_DFLDm.fits (e.g. 8202-33_NGC1068_DFLD1.fits)

where

TARGET-ID is the object identification number assigned during the mission. Each Shuttle pointing had a unique Target ID.
MTL-NAME is the Mission Target List name.
DFLD denotes Downfield Camera data
m is a counter

o Description of WUPPE Downfield Camera FITS files

The FITS files were written on a digital DECstation 5000/240 using DEC FORTRAN for Ultrix RISC Systems, running Ultrix 4.2. We used the FITSIO package, version 3.2, written by William Pence at the Goddard Spaceflight Center.

Each file is 158400 bytes in length (310 VMS blocks).

The set of basic header information includes the primary array keywords and keywords describing the instrument, data arrays and the telescope observational and engineering data for the Downfield FITS file.

An example header of a FITS file is given below.

Each Downfield image consists of 320x240 integer*2 words. In two cases (see above), there were corrupted or missing frames (out of a total of 16 frames for the Downfield Image). These data

have been zeroed out.

o FITS file header

FITS file = 8202-33_NGC1068_DFLD1.fits

```
SIMPLE  =                    T / file does conform to FITS standard
BITPIX  =                   16 / number of bits per data pixel
NAXIS   =                    2 / number of data axes
NAXIS1  =                  320 / length of data axis   1
NAXIS2  =                  240 / length of data axis   2
COMMENT   WUPPE Downfield Image:320x240 data points
CTYPE1  = 'Pixel   '            / Pixel Number
CRPIX1  =                  1.0 / Starting pixel number
CRVAL1  =                  0.0 / Starting pixel value
CDELT1  =                  1.0 / Delta pixel number
CTYPE2  = 'Row     '            / Row Number
CRPIX2  =                  1.0 / Starting row number
CRVAL2  =                  0.0 / Starting row value
CDELT2  =                  1.0 / Delta row number
ORIGIN  = 'UW-Space Astronomy Lab' / Creator of FITS file
DATE    = 'Tue Apr 13 20:16:28 1993' / Date FITS file was created
OBSERVAT= 'ASTRO-1 '            / Observatory
TELESCOP= 'WUPPE   '            / Telescope
INSTRUME= 'SPECTROPOLARIMETER' / Instrument Used
OBJECT  = 'NGC1068 '            / Object Observed
ID      = '8202-33 '            / Target ID
PRIME   = 'HUT     '            / Prime Instrument
EQUINOX =              1950.00 / Equinox for coordinates
RA      =              40.0295 / Right ascension in degrees
DEC     =              -0.2254 / Declination in degrees
GMTTIME = '342/ 8:57:30'        / GMT time of data readout
METTIME = '6/ 2: 8:29'          / MET time of data readout
BOS     =                25.0 / Bright Object Sensor reading
```

o File verification

The program "dfldfitsread.f" was written to verify the contents of the Downfield Camera Image FITS files. It also uses the GSFC FITSIO software package. The program is provided here along with the ASCII output from this program ("8202-33_NGC1068_DFLD1.dump") for the example Level 0 FITS file. It prints only data j=121,160 (the center of the image) of the 320 data wide image.
SAOIMAGE (on a unix machine) was also used to verify the Downfield Camera Image FITS files.

o The complete data set

The entire set of Downfield FITS files (by ID/object) have been written to a DAT tape by the unix "tar" command. There are 15 Downfield images (2.5 Megabytes total).
There are 14 "tar" files on this DAT tape. The first file on the tape contains the Downfield images discussed in this document.
A table of contents listing for the "tar" file of the DAT tape is also included in this package.

tar file #	contents (ordered by target ID)
1	all 15 WUPPE Downfield Images

o Further Information

To request copies of relevant WUPPE documents, preprints/reprints, bibliography, or general questions, please contact Marilyn Meade at the UW Space Astronomy Laboratory, Chamberlin Hall, 1150 University Avenue, Madison, WI 53706, telephone (608) 263-4678, or by email at meade@sal.wisc.edu or MADRAF::MEADE.

Astro - 01C

WUPPE Data Archive
Level 0 Raw Zoom Camera Image Data FITS files

23 February 1993

by Marilyn R. Meade

o Description of the Instrument

The Wisconsin Ultraviolet Photo-Polarimeter Experiment (WUPPE) is one of three ultraviolet telescopes on the ASTRO-1 payload which flew aboard the space shuttle Columbia during a nine day mission in December 1990. WUPPE is a 0.5m f/10 Cassegrain telescope and spectropolarimeter. It obtained simultaneous spectra and polarization measurements, with a spectral resolution of about 10A, from 1400 to 3200A. A set of halfwave plates at 6 different angles provide spectropolarimetric modulation with 10A resolution on point sources through apertures from 6 to 40 arcsec. A "Lyot" analyzer is used to provide 50-100A spectropolarimetric resolution on faint point targets and diffuse nebulae. The typical diffuse object aperture was 3x50 arcsec. Calibrations of instrumental polarimetric efficiency, residual polarization, position angle registration, and flux sensitivity were performed by a combination of preflight laboratory measures and in-flight standard star observations. The data are corrected for telemetry errors, thermal background, cosmic ray hits, second order contamination, pointing errors, and instrumental polarization, which is roughly 0.05%.

o Level 0 Data

Level 0 data products include field and zoom camera images, spectrometer scans and housekeeping (General Measurement Loop (GML)) data. The WUPPE data have been stripped from the Goddard SpaceLab Data Processing Facility (SLDPF) tapes. The individual field, zoom, GML and spectrometer files from the tapes were combined to form one file of each type of data for each 12 hour time slice of the mission.

o Camera Data

The zero order light of the WUPPE spectrometer is diverted to an intensified CCD camera which makes it possible for the experiment team to acquire and guide upon faint targets and targets in crowded fields. There are three camera modes: field, zoom and downfield. The field mode is used for identification and acquisition of the targets. Its size is 3.3 x 4.4 arcmin, 320 x 256 pixels using a 1-bit display. The zoom mode is used for fine pointing and focus. The size of the image is 24 x 32 arcsec, 30 x 40 pixels using a 6-bit grey scale display. The downfield data is similar to the field data except it uses the 6-bit grey scale display and is used to produce a more detailed picture of the field around the object of interest.

The Zoom camera data are provided to the NSSDC in FITS files in this installment of data delivery. Each 12 hour time slice of data

contains hundreds to thousands of zoom camera images.

Level 0 Raw Zoom Camera Data FITS File naming convention

There are 10 WUPPE raw zoom camera images in one level 0 raw zoom camera data FITS file.

The files are named as follows:

DAYxxZOOMmmmm.FITS

where

xx is the MET day number times 10 (00,05,10,...,80) (on unix, the files were 0.0,0.5,1.0...but VMS will not accept the extra ".")

mmmm is the beginning raw zoom camera image number from the original (12-hour time slice) zoom file.

For example, FITS file "DAY05ZOOM0001.FITS" contains raw images 1 through 10 from day 0.5. "DAY05ZOOM0011.FITS" contains raw images 11 through 20 from day 0.5.

o Description of WUPPE Raw Zoom Camera FITS files and Sample Files

DAY55SAMP0191.FITS and DAY55SAMP0201.FITS have been copied into

MADRAF::MEADE:[MEADE.LEVEL0.ZOOM]

These files contain images 191 -210 from day 5.5 and were taken during a WUPPE target observation. (One can see the object in the field of view in the ASCII dump file day55samp0191.dump (see below)).

They were written on a digital DECstation 5000/240 using DEC Fortran for Ultrix RISC Systems, running Ultrix 4.2. We used the FITSIO package, version 3.2, written by William Pence at the Goddard Spaceflight Center.

Each file is 40320 bytes in length (79 VMS blocks).

The set of basic header information includes the primary array keywords and keywords describing the instrument and data arrays and 12 keywords describing the telescope observational and engineering data for each of the 10 raw zoom camera images in the FITS file.

The sample files include the following comment records to distinguish them from the actual data files:

```
COMMENT   This is a sample Level 0 WUPPE Zoom Camera
COMMENT   Image FITS file. Data are not to be
COMMENT   distributed.
```

The headers of the sample files are given below.

Each zoom image consists of 40x30 integer*2 words. The FITS file then contains 40x30x10 integer*2 words. If there were not enough zoom images to complete a 10 image FITS file, zero-filled data were written to the FITS file. In addition, if the data in the original 12 hour time slice file were so corrupted as to be unreadable, a FILLER image was written

in its place. The second sample file (DAY55SAMP0201.FITS) shows examples of FILLER images.

FITS file header

FITS file = DAY55SAMP0191.FITS

```
SIMPLE  =                    T / file does conform to FITS standard
BITPIX  =                   16 / number of bits per data pixel
NAXIS   =                    3 / number of data axes
NAXIS1  =                   40 / length of data axis   1
NAXIS2  =                   30 / length of data axis   2
NAXIS3  =                   10 / length of data axis   3
COMMENT   Each zoom image has 40x30 data points
COMMENT   There are 10 zoom images in each FITS file
CTYPE1  = 'Pixel   '             / Pixel Number
CRPIX1  =                  1.0 / Starting pixel number
CRVAL1  =                 12.0 / Starting pixel value
CDELT1  =                  1.0 / Delta pixel number
CTYPE2  = 'Row     '             / Row Number
CRPIX2  =                  1.0 / Starting row number
CRVAL2  =                 12.0 / Starting row value
CDELT2  =                  1.0 / Delta row number
CTYPE3  = 'Image No.'            / Zoom Image Number
CRPIX3  =                  1.0 / Starting image number
CRVAL3  =                  1.0 / Starting image value
CDELT3  =                  1.0 / Delta image number
ORIGIN  = 'UW-Space Astronomy Lab' / Creator of FITS file
DATE    = 'Fri Jan 29 13:58:39 1993' / Date FITS file was created
OBSERVAT= 'ASTRO-1 '             / Observatory
TELESCOP= 'WUPPE   '             / Telescope
INSTRUME= 'SPECTROPOLARIMETER' / Instrument Used
ZOOM01  =                  191 / Zoom Image Number
CURSEQ01=                  375 / Current Sequence Number
STATUS01= '7: OBS  '             / Instrument Status Mode
APER01  =                    7 / Aperture
FILT01  =                    4 / Filter
GMTTIM01= '341/20:46:43'         / GMT time of data readout
METTIM01= '5/13:57:42'           / MET time of data readout
SAT01   =                 29.0 / %Saturation
BOS01   =                  8.2 / Bright Object Sensor reading
MAXCTS01=                   20 / Maximum counts in Zoom Image
QUAL01  =                    0 / SLDPF Quality Flag (max)
IMAGE01 = 'ZOOM IMAGE'           / Zoom Image
ZOOM02  =                  192 / Zoom Image Number
CURSEQ02=                  375 / Current Sequence Number
STATUS02= '7: OBS  '             / Instrument Status Mode
APER02  =                    7 / Aperture
FILT02  =                    4 / Filter
GMTTIM02= '341/20:46:51'         / GMT time of data readout
METTIM02= '5/13:57:50'           / MET time of data readout
SAT02   =                 29.0 / %Saturation
BOS02   =                  8.2 / Bright Object Sensor reading
MAXCTS02=                   21 / Maximum counts in Zoom Image
QUAL02  =                    0 / SLDPF Quality Flag (max)
IMAGE02 = 'ZOOM IMAGE'           / Zoom Image
ZOOM03  =                  193 / Zoom Image Number
CURSEQ03=                  375 / Current Sequence Number
STATUS03= '7: OBS  '             / Instrument Status Mode
```

```
APER03  =                    7 / Aperture
FILT03  =                    4 / Filter
GMTTIM03= '341/20:46:59'       / GMT time of data readout
METTIM03= '5/13:57:58'         / MET time of data readout
SAT03   =                 29.0 / %Saturation
BOS03   =                  8.2 / Bright Object Sensor reading
MAXCTS03=                   22 / Maximum counts in Zoom Image
QUAL03  =                    0 / SLDPF Quality Flag (max)
IMAGE03 = 'ZOOM IMAGE'         / Zoom Image
ZOOM04  =                  194 / Zoom Image Number
CURSEQ04=                  375 / Current Sequence Number
STATUS04= '7: OBS  '           / Instrument Status Mode
APER04  =                    7 / Aperture
FILT04  =                    4 / Filter
GMTTIM04= '341/20:47: 7'       / GMT time of data readout
METTIM04= '5/13:58: 6'         / MET time of data readout
SAT04   =                 29.0 / %Saturation
BOS04   =                  8.2 / Bright Object Sensor reading
MAXCTS04=                   21 / Maximum counts in Zoom Image
QUAL04  =                    0 / SLDPF Quality Flag (max)
IMAGE04 = 'ZOOM IMAGE'         / Zoom Image
ZOOM05  =                  195 / Zoom Image Number
CURSEQ05=                  375 / Current Sequence Number
STATUS05= '7: OBS  '           / Instrument Status Mode
APER05  =                    7 / Aperture
FILT05  =                    4 / Filter
GMTTIM05= '341/20:47:16'       / GMT time of data readout
METTIM05= '5/13:58:15'         / MET time of data readout
SAT05   =                 29.0 / %Saturation
BOS05   =                  8.2 / Bright Object Sensor reading
MAXCTS05=                   21 / Maximum counts in Zoom Image
QUAL05  =                    0 / SLDPF Quality Flag (max)
IMAGE05 = 'ZOOM IMAGE'         / Zoom Image
ZOOM06  =                  196 / Zoom Image Number
CURSEQ06=                  375 / Current Sequence Number
STATUS06= '7: OBS  '           / Instrument Status Mode
APER06  =                    7 / Aperture
FILT06  =                    4 / Filter
GMTTIM06= '341/20:47:24'       / GMT time of data readout
METTIM06= '5/13:58:23'         / MET time of data readout
SAT06   =                 29.0 / %Saturation
BOS06   =                  8.0 / Bright Object Sensor reading
MAXCTS06=                   19 / Maximum counts in Zoom Image
QUAL06  =                    0 / SLDPF Quality Flag (max)
IMAGE06 = 'ZOOM IMAGE'         / Zoom Image
ZOOM07  =                  197 / Zoom Image Number
CURSEQ07=                  375 / Current Sequence Number
STATUS07= '7: OBS  '           / Instrument Status Mode
APER07  =                    7 / Aperture
FILT07  =                    4 / Filter
GMTTIM07= '341/20:47:32'       / GMT time of data readout
METTIM07= '5/13:58:31'         / MET time of data readout
SAT07   =                 29.0 / %Saturation
BOS07   =                  8.0 / Bright Object Sensor reading
MAXCTS07=                   20 / Maximum counts in Zoom Image
QUAL07  =                    0 / SLDPF Quality Flag (max)
IMAGE07 = 'ZOOM IMAGE'         / Zoom Image
ZOOM08  =                  198 / Zoom Image Number
CURSEQ08=                  375 / Current Sequence Number
```

```
STATUS08= '7: OBS  '            / Instrument Status Mode
APER08  =                     7 / Aperture
FILT08  =                     4 / Filter
GMTTIM08= '341/20:47:40'        / GMT time of data readout
METTIM08= '5/13:58:39'          / MET time of data readout
SAT08   =                  29.0 / %Saturation
BOS08   =                   7.9 / Bright Object Sensor reading
MAXCTS08=                    22 / Maximum counts in Zoom Image
QUAL08  =                     0 / SLDPF Quality Flag (max)
IMAGE08 = 'ZOOM IMAGE'          / Zoom Image
ZOOM09  =                   199 / Zoom Image Number
CURSEQ09=                   375 / Current Sequence Number
STATUS09= '7: OBS  '            / Instrument Status Mode
APER09  =                     7 / Aperture
FILT09  =                     4 / Filter
GMTTIM09= '341/20:47:48'        / GMT time of data readout
METTIM09= '5/13:58:47'          / MET time of data readout
SAT09   =                  29.0 / %Saturation
BOS09   =                   8.0 / Bright Object Sensor reading
MAXCTS09=                    21 / Maximum counts in Zoom Image
QUAL09  =                     0 / SLDPF Quality Flag (max)
IMAGE09 = 'ZOOM IMAGE'          / Zoom Image
ZOOM10  =                   200 / Zoom Image Number
CURSEQ10=                   375 / Current Sequence Number
STATUS10= '7: OBS  '            / Instrument Status Mode
APER10  =                     7 / Aperture
FILT10  =                     4 / Filter
GMTTIM10= '341/20:47:56'        / GMT time of data readout
METTIM10= '5/13:58:55'          / MET time of data readout
SAT10   =                  29.0 / %Saturation
BOS10   =                   7.9 / Bright Object Sensor reading
MAXCTS10=                    23 / Maximum counts in Zoom Image
QUAL10  =                     0 / SLDPF Quality Flag (max)
IMAGE10 = 'ZOOM IMAGE'          / Zoom Image
COMMENT   This is a sample Level 0 WUPPE Zoom Camera
COMMENT   Image FITS file. Data are not to be
COMMENT   distributed
```

FITS file = DAY55SAMP0201.FITS (note that the last 2 zoom images in the file are filler images.)
(Abbreviated header, to save space)

```
SIMPLE  =                     T / file does conform to FITS standard
BITPIX  =                    16 / number of bits per data pixel
NAXIS   =                     3 / number of data axes
NAXIS1  =                    40 / length of data axis   1
NAXIS2  =                    30 / length of data axis   2
NAXIS3  =                    10 / length of data axis   3
COMMENT   Each zoom image has 40x30 data points
COMMENT   There are 10 zoom images in each FITS file
CTYPE1  = 'Pixel   '            / Pixel Number
CRPIX1  =                   1.0 / Starting pixel number
CRVAL1  =                  13.0 / Starting pixel value
CDELT1  =                   1.0 / Delta pixel number
CTYPE2  = 'Row     '            / Row Number
CRPIX2  =                   1.0 / Starting row number
CRVAL2  =                  13.0 / Starting row value
CDELT2  =                   1.0 / Delta row number
CTYPE3  = 'Image No.'           / Zoom Image Number
```

```
CRPIX3  =                  1.0 / Starting image number
CRVAL3  =                  1.0 / Starting image value
CDELT3  =                  1.0 / Delta image number
ORIGIN  = 'UW-Space Astronomy Lab' / Creator of FITS file
DATE    = 'Fri Jan 29 13:58:39 1993' / Date FITS file was created
OBSERVAT= 'ASTRO-1 '             / Observatory
TELESCOP= 'WUPPE   '             / Telescope
INSTRUME= 'SPECTROPOLARIMETER' / Instrument Used
ZOOM01  =                  201 / Zoom Image Number
CURSEQ01=                  375 / Current Sequence Number
STATUS01= '7: OBS  '             / Instrument Status Mode
APER01  =                    7 / Aperture
FILT01  =                    4 / Filter
GMTTIM01= '341/20:48: 5'         / GMT time of data readout
METTIM01= '5/13:59: 4'           / MET time of data readout
SAT01   =                 29.0 / %Saturation
BOS01   =                  7.9 / Bright Object Sensor reading
MAXCTS01=                   29 / Maximum counts in Zoom Image
QUAL01  =                    0 / SLDPF Quality Flag (max)
IMAGE01 = 'ZOOM IMAGE'           / Zoom Image
ZOOM02  =                  202 / Zoom Image Number
CURSEQ02=                  375 / Current Sequence Number
STATUS02= '7: OBS  '             / Instrument Status Mode
APER02  =                    7 / Aperture
FILT02  =                    4 / Filter
GMTTIM02= '341/20:48:13'         / GMT time of data readout
METTIM02= '5/13:59:12'           / MET time of data readout
SAT02   =                 29.0 / %Saturation
BOS02   =                  7.9 / Bright Object Sensor reading
MAXCTS02=                   18 / Maximum counts in Zoom Image
QUAL02  =                    0 / SLDPF Quality Flag (max)
IMAGE02 = 'ZOOM IMAGE'           / Zoom Image
    .
    .
    .
ZOOM08  =                  208 / Zoom Image Number
CURSEQ08=                  375 / Current Sequence Number
STATUS08= '7: OBS  '             / Instrument Status Mode
APER08  =                    7 / Aperture
FILT08  =                    4 / Filter
GMTTIM08= '341/20:49: 2'         / GMT time of data readout
METTIM08= '5/14: 0: 1'           / MET time of data readout
SAT08   =                 29.0 / %Saturation
BOS08   =                  8.2 / Bright Object Sensor reading
MAXCTS08=                   20 / Maximum counts in Zoom Image
QUAL08  =                    0 / SLDPF Quality Flag (max)
IMAGE08 = 'ZOOM IMAGE'           / Zoom Image
ZOOM09  =                  209 / Zoom Image Number
CURSEQ09=                    0 / Current Sequence Number
STATUS09= '0:      '             / Instrument Status Mode
APER09  =                    0 / Aperture
FILT09  =                    0 / Filter
GMTTIM09= '0/ 0: 0: 0'           / GMT time of data readout
METTIM09= '0/ 0: 0: 0'           / MET time of data readout
SAT09   =                  0.0 / %Saturation
BOS09   =                  0.0 / Bright Object Sensor reading
MAXCTS09=                    0 / Maximum counts in Zoom Image
QUAL09  =                    0 / SLDPF Quality Flag (max)
IMAGE09 = 'FILLER IMAGE'         / Zero-Filled Zoom Image
```

```
ZOOM10  =                   210 / Zoom Image Number
CURSEQ10=                     0 / Current Sequence Number
STATUS10= '0:       '           / Instrument Status Mode
APER10  =                     0 / Aperture
FILT10  =                     0 / Filter
GMTTIM10= '0/ 0: 0: 0'          / GMT time of data readout
METTIM10= '0/ 0: 0: 0'          / MET time of data readout
SAT10   =                   0.0 / %Saturation
BOS10   =                   0.0 / Bright Object Sensor reading
MAXCTS10=                     0 / Maximum counts in Zoom Image
QUAL10  =                     0 / SLDPF Quality Flag (max)
IMAGE10 = 'FILLER IMAGE'        / Zero-Filled Zoom Image
COMMENT   This is a sample Level 0 WUPPE Zoom Camera
COMMENT   Image FITS file. Data are not to be
COMMENT   distributed
```

o File verification

The program "zoomfitsread.f" was written to verify the contents of the sample Level 0 Zoom Camera Image FITS files. It also uses the GSFC FITSIO software package. The program is provided here along with the ASCII output files from this program ("day55samp0191.dump" and "day55samp0201.dump") for the 2 sample Level 0 FITS files.
IRAF (on a VMS machine) was also used to verify the Zoom Camera Image FITS files.

o The complete data set

The entire set of FITS files have been written to a DAT tape by the unix "tar" command. There are approximately 7100 (284 Megabytes total) WUPPE Level 0 Zoom Camera Image FITS files, each with 10 raw zoom images. There are 17 "tar" files on this DAT tape. Each of the "tar" files contains the WUPPE level 0 zoom camera image data for a 12 hour time slice of the mission. A table of contents listing for each "tar" file of the DAT tape is also included in this package.

tar file #	contents	# FITS files/"tar" file
1	day0.0	78
2	day0.5	171
3	day1.0	577
4	day1.5	623
5	day2.0	449
6	day2.5	691
7	day3.0	614
8	day3.5	633
9	day4.0	285
10	day4.5	10
11	day5.0	254
12	day5.5	440
13	day6.0	709
14	day6.5	421
15	day7.0	414
16	day7.5	420
17	day8.0	311

o Further Information

To request copies of relevant WUPPE documents, preprints/reprints,

bibliography, or general questions, please contact Marilyn Meade at the UW Space Astronomy Laboratory, Chamberlin Hall, 1150 University Avenue, Madison, WI 53706, telephone (608) 263-4678, or by email at meade@sal.wisc.edu or MADRAF::MEADE.

WUPPE Data Archive
Level 0 Raw Zoom Camera Image Data FITS files
Data Ordered by ID/Object

4 May 1993

by Marilyn R. Meade

o Description of the Instrument

The Wisconsin Ultraviolet Photo-Polarimeter Experiment (WUPPE) is one of three ultraviolet telescopes on the ASTRO-1 payload which flew aboard the space shuttle Columbia during a nine day mission in December 1990. WUPPE is a 0.5m f/10 Cassegrain telescope and spectropolarimeter. It obtained simultaneous spectra and polarization measurements, with a spectral resolution of about 10A, from 1400 to 3200A. A set of halfwave plates at 6 different angles provide spectropolarimetric modulation with 10A resolution on point sources through apertures from 6 to 40 arcsec. A "Lyot" analyzer is used to provide 50-100A spectropolarimetric resolution on faint point targets and diffuse nebulae. The typical diffuse object aperture was 3x50 arcsec. Calibrations of instrumental polarimetric efficiency, residual polarization, position angle registration, and flux sensitivity were performed by a combination of preflight laboratory measures and in-flight standard star observations. The data are corrected for telemetry errors, thermal background, cosmic ray hits, second order contamination, pointing errors, and instrumental polarization, which is roughly 0.05%.

o Level 0 Data

Level 0 data products include field and zoom camera images, spectrometer scans and housekeeping (General Measurement Loop (GML)) data. The WUPPE data have been stripped from the Goddard SpaceLab Data Processing Facility (SLDPF) tapes. The individual field, zoom, GML and spectrometer files from the tapes were combined to form one file of each type of data for each 12 hour time slice of the mission.

o Camera Data

The zero order light of the WUPPE spectrometer is diverted to an intensified CCD camera which makes it possible for the experiment team to acquire and guide upon faint targets and targets in crowded fields. There are three camera modes: field, zoom and downfield. The field mode is used for identification and acquisition of the targets. Its size is 3.3 x 4.4 arcmin, 320 x 256 pixels using a 1-bit display. The zoom mode is used for fine pointing and focus. The size of the image is 24 x 32 arcsec, 30 x 40 pixels using a 6-bit grey scale display. The downfield data is similar to the field data except it uses the 6-bit grey scale display and is used to produce a more detailed picture of the field around the object of interest. Each 12 hour time slice of data contains hundreds to thousands of zoom camera images.

The entire mission raw zoom camera files were delivered previously. The data set delivered here includes only the raw zoom images taken during observations of science targets.

o Level 0 Raw Zoom Camera Data FITS File naming convention

There are 10 WUPPE raw zoom camera images in one level 0 raw zoom camera data FITS file.

The files are named as follows:

TARGET-ID_MTL-NAME_Zmmmm.fits (e.g. 0010-14_BD284211_Z0001.fits)

where

TARGET-ID is the object identification number assigned during the mission. Each Shuttle pointing had a unique Target ID.
MTL-NAME is the Mission Target List name.
Z denotes Zoom Camera data
mmmm is the beginning raw zoom image number of the FITS file

For example, FITS file "0010-14_BD284211_Z0001.fits" contains raw zoom images 1 through 10 that pertain to the 0010-14 observation of BD+28 4211. File "0010-14_BD284211_Z0011.fits" contains raw scans 11 through 20.

o Description of WUPPE Raw Zoom Camera FITS files

The FITS files were written on a digital DECstation 5000/240 using DEC FORTRAN for Ultrix RISC Systems, running Ultrix 4.2. We used the FITSIO package, version 3.2, written by William Pence at the Goddard Spaceflight Center.

Each file is 40320 bytes in length (79 VMS blocks).

The set of basic header information includes the primary array keywords and keywords describing the instrument and data arrays and 12 keywords describing the telescope observational and engineering data for each of the 10 raw zoom camera images in the FITS file.

An example header of a FITS file is given below.

Each zoom image consists of 40x30 integer*2 words. The FITS file then contains 40x30x10 integer*2 words. If there were not enough zoom images to complete a 10 image FITS file, zero-filled data (a FILLER image) were written to the FITS file. In addition, if the data in the original 12 hour time slice file were so badly corrupted as to be unreadable, a FILLER image was written in its place.

o FITS file header

FITS file = 0010-14_BD284211_Z0001.fits

```
SIMPLE  =                    T / file does conform to FITS standard
BITPIX  =                   16 / number of bits per data pixel
NAXIS   =                    3 / number of data axes
NAXIS1  =                   40 / length of data axis   1
```

```
NAXIS2  =                   30 / length of data axis   2
NAXIS3  =                   10 / length of data axis   3
COMMENT   Each zoom image has 40x30 data points
COMMENT   There are 10 zoom images in each FITS file
CTYPE1  = 'Pixel   '           / Pixel Number
CRPIX1  =                  1.0 / Starting pixel number
CRVAL1  =                 11.0 / Starting pixel value
CDELT1  =                  1.0 / Delta pixel number
CTYPE2  = 'Row     '           / Row Number
CRPIX2  =                  1.0 / Starting row number
CRVAL2  =                 11.0 / Starting row value
CDELT2  =                  1.0 / Delta row number
CTYPE3  = 'Image No.'          / Zoom Image Number
CRPIX3  =                  1.0 / Starting image number
CRVAL3  =                  1.0 / Starting image value
CDELT3  =                  1.0 / Delta image number
ORIGIN  = 'UW-Space Astronomy Lab' / Creator of FITS file
DATE    = 'Thu Mar 11 16:16:14 1993' / Date FITS file was created
OBSERVAT= 'ASTRO-1 '           / Observatory
TELESCOP= 'WUPPE   '           / Telescope
INSTRUME= 'SPECTROPOLARIMETER' / Instrument Used
OBJECT  = 'BD284211'           / Object Observed
ID      = '0010-14 '           / Target ID
PRIME   = 'HUT     '           / Prime Instrument
EQUINOX =              1950.00 / Equinox for coordinates
RA      =            327.2391 / Right ascension in degrees
DEC     =             28.6261 / Declination in degrees
GMTSTART= '342/20:50:07'       / GMT start time of observation
GMTSTOP = '342/20:58:31'       / GMT stop time of observation
METSTART= '6/14: 1:06'         / Mission Elapsed Time start time
METSTOP = '6/14: 9:30'         / Mission Elapsed Time stop time
ZOOM01  =                    1 / Zoom Image Number
CURSEQ01=                  233 / Current Sequence Number
STATUS01= '7: OBS  '           / Instrument Status Mode
APER01  =                    1 / Aperture
FILT01  =                    6 / Filter
GMTTIM01= '342/20:50:10'       / GMT time of data readout
METTIM01= '6/14: 1: 9'         / MET time of data readout
SAT01   =                 77.0 / %Saturation
BOS01   =                 -2.1 / Bright Object Sensor reading
MAXCTS01=                   40 / Maximum counts in Zoom Image
QUAL01  =                    0 / SLDPF Quality Flag (max)
IMAGE01 = 'ZOOM IMAGE'         / Zoom Image
ZOOM02  =                    2 / Zoom Image Number
CURSEQ02=                  233 / Current Sequence Number
STATUS02= '7: OBS  '           / Instrument Status Mode
APER02  =                    1 / Aperture
FILT02  =                    6 / Filter
GMTTIM02= '342/20:50:18'       / GMT time of data readout
METTIM02= '6/14: 1:17'         / MET time of data readout
SAT02   =                 77.0 / %Saturation
BOS02   =                 -2.2 / Bright Object Sensor reading
MAXCTS02=                   40 / Maximum counts in Zoom Image
QUAL02  =                    0 / SLDPF Quality Flag (max)
IMAGE02 = 'ZOOM IMAGE'         / Zoom Image
ZOOM03  =                    3 / Zoom Image Number
CURSEQ03=                  233 / Current Sequence Number
STATUS03= '7: OBS  '           / Instrument Status Mode
APER03  =                    1 / Aperture
```

```
FILT03  =                    7 / Filter
GMTTIM03= '342/20:50:27'       / GMT time of data readout
METTIM03= '6/14: 1:26'         / MET time of data readout
SAT03   =                 77.0 / %Saturation
BOS03   =                 -2.1 / Bright Object Sensor reading
MAXCTS03=                   35 / Maximum counts in Zoom Image
QUAL03  =                    0 / SLDPF Quality Flag (max)
IMAGE03 = 'ZOOM IMAGE'         / Zoom Image
ZOOM04  =                    4 / Zoom Image Number
CURSEQ04=                  233 / Current Sequence Number
STATUS04= '7: OBS  '           / Instrument Status Mode
APER04  =                    1 / Aperture
FILT04  =                    7 / Filter
GMTTIM04= '342/20:50:35'       / GMT time of data readout
METTIM04= '6/14: 1:34'         / MET time of data readout
SAT04   =                 77.0 / %Saturation
BOS04   =                 -2.2 / Bright Object Sensor reading
MAXCTS04=                   35 / Maximum counts in Zoom Image
QUAL04  =                    0 / SLDPF Quality Flag (max)
IMAGE04 = 'ZOOM IMAGE'         / Zoom Image
ZOOM05  =                    5 / Zoom Image Number
CURSEQ05=                  233 / Current Sequence Number
STATUS05= '7: OBS  '           / Instrument Status Mode
APER05  =                    1 / Aperture
FILT05  =                    6 / Filter
GMTTIM05= '342/20:50:43'       / GMT time of data readout
METTIM05= '6/14: 1:42'         / MET time of data readout
SAT05   =                 77.0 / %Saturation
BOS05   =                 -2.1 / Bright Object Sensor reading
MAXCTS05=                   34 / Maximum counts in Zoom Image
QUAL05  =                    0 / SLDPF Quality Flag (max)
IMAGE05 = 'ZOOM IMAGE'         / Zoom Image
ZOOM06  =                    6 / Zoom Image Number
CURSEQ06=                  233 / Current Sequence Number
STATUS06= '7: OBS  '           / Instrument Status Mode
APER06  =                    1 / Aperture
FILT06  =                    6 / Filter
GMTTIM06= '342/20:50:51'       / GMT time of data readout
METTIM06= '6/14: 1:50'         / MET time of data readout
SAT06   =                 77.0 / %Saturation
BOS06   =                 -2.2 / Bright Object Sensor reading
MAXCTS06=                   31 / Maximum counts in Zoom Image
QUAL06  =                    0 / SLDPF Quality Flag (max)
IMAGE06 = 'ZOOM IMAGE'         / Zoom Image
ZOOM07  =                    7 / Zoom Image Number
CURSEQ07=                  233 / Current Sequence Number
STATUS07= '7: OBS  '           / Instrument Status Mode
APER07  =                    1 / Aperture
FILT07  =                    6 / Filter
GMTTIM07= '342/20:50:59'       / GMT time of data readout
METTIM07= '6/14: 1:58'         / MET time of data readout
SAT07   =                 77.0 / %Saturation
BOS07   =                 -2.1 / Bright Object Sensor reading
MAXCTS07=                   19 / Maximum counts in Zoom Image
QUAL07  =                    0 / SLDPF Quality Flag (max)
IMAGE07 = 'ZOOM IMAGE'         / Zoom Image
ZOOM08  =                    8 / Zoom Image Number
CURSEQ08=                  233 / Current Sequence Number
STATUS08= '7: OBS  '           / Instrument Status Mode
```

```
APER08  =                    1 / Aperture
FILT08  =                    7 / Filter
GMTTIM08= '342/20:51: 8'       / GMT time of data readout
METTIM08= '6/14: 2: 7'         / MET time of data readout
SAT08   =                 77.0 / %Saturation
BOS08   =                 -2.1 / Bright Object Sensor reading
MAXCTS08=                   38 / Maximum counts in Zoom Image
QUAL08  =                    0 / SLDPF Quality Flag (max)
IMAGE08 = 'ZOOM IMAGE'         / Zoom Image
ZOOM09  =                    9 / Zoom Image Number
CURSEQ09=                  233 / Current Sequence Number
STATUS09= '7: OBS  '           / Instrument Status Mode
APER09  =                    1 / Aperture
FILT09  =                    7 / Filter
GMTTIM09= '342/20:51:16'       / GMT time of data readout
METTIM09= '6/14: 2:15'         / MET time of data readout
SAT09   =                 77.0 / %Saturation
BOS09   =                 -2.1 / Bright Object Sensor reading
MAXCTS09=                   30 / Maximum counts in Zoom Image
QUAL09  =                    0 / SLDPF Quality Flag (max)
IMAGE09 = 'ZOOM IMAGE'         / Zoom Image
ZOOM10  =                   10 / Zoom Image Number
CURSEQ10=                  233 / Current Sequence Number
STATUS10= '7: OBS  '           / Instrument Status Mode
APER10  =                    1 / Aperture
FILT10  =                    6 / Filter
GMTTIM10= '342/20:51:24'       / GMT time of data readout
METTIM10= '6/14: 2:23'         / MET time of data readout
SAT10   =                 77.0 / %Saturation
BOS10   =                 -2.1 / Bright Object Sensor reading
MAXCTS10=                   38 / Maximum counts in Zoom Image
QUAL10  =                    0 / SLDPF Quality Flag (max)
IMAGE10 = 'ZOOM IMAGE'         / Zoom Image
```

o File verification

The program "zoomfitsread.f" was written to verify the contents of the Level 0 Zoom Camera Image FITS files. It also uses the GSFC FITSIO software package. The program is provided here along with the ASCII output from this program ("0010-14_BD284211_Z0001.dump") for the example Level 0 FITS file.
IRAF (on a VMS machine) was also used to verify the Zoom Camera Image FITS files.

o The complete data set

The entire set of FITS files by ID/object have been written to a DAT tape by the unix "tar" command. There are approximately 1930 (78 Megabytes total) WUPPE Level 0 Zoom Camera Image FITS files, each with 10 raw zoom images. There are 14 "tar" files on this DAT tape. 4 of these "tar" files contain the zoom images discussed in this document.
A table of contents listing for each "tar" file of the DAT tape is also included in this package.

tar file #	contents (ordered by target ID)
2	0*.fits,1*.fits
3	2*.fits
4	3*.fits,4*.fits

5 5*.fits,6*.fits*,7*.fits,8*.fits,9*.fits

o Further Information

To request copies of relevant WUPPE documents, preprints/reprints, bibliography, or general questions, please contact Marilyn Meade at the UW Space Astronomy Laboratory, Chamberlin Hall, 1150 University Avenue, Madison, WI 53706, telephone (608) 263-4678, or by email at meade@sal.wisc.edu or MADRAF::MEADE.